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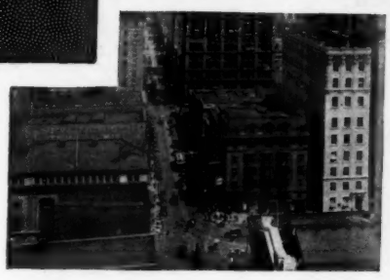
PUBLIC WORKS

CITY COUNTY STATE

BALTIMORE AND TEXACO



Baltimore Street, the main thoroughfare in Baltimore, paved in 1914 with TEXACO Sheet Asphalt. Photo taken August, 1921.

Baltimore this month acts as host to the members of the American Society for Municipal Improvements.

Suitable, indeed, is Baltimore as a meeting place for such a body of experts, for no other American city has accomplished more in harbor expansion, industrial and commercial growth, park and residential development, and general municipal improvements.

Eutaw Street, in Baltimore's shopping district, paved in 1912 with TEXACO Sheet Asshalt. Photo taken August, 1921.

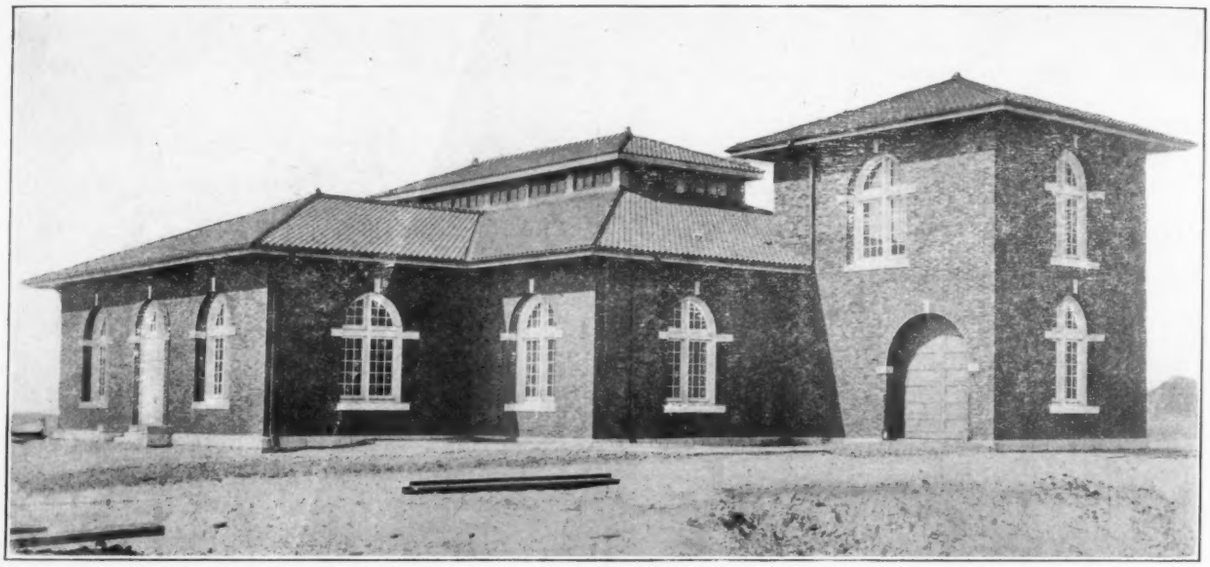
As Baltimore proudly receives the A. S. M. I., so The Texas Company in the same spirit welcomes the opportunity of showing America's leading engineers the excellent TEXACO Asphalt pavements in Baltimore, of which pavements R. Keith Compton, President of the A. S. M. I. and engineer of the city's paving commission, writes:

"The present condition of all TEXACO streets is excellent."

The Texas Company

Asphalt Sales Dept., 17 Battery Pl., New York City

OCT 1921



Bridgeport, Conn. Superstructure of Largest Fine Screen Sewage Treatment Plant

Hydraulic and Sanitary Equipment For Municipal Water Works and Sewage Treatment Plants

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D'Olier Centrifugal Pumps.
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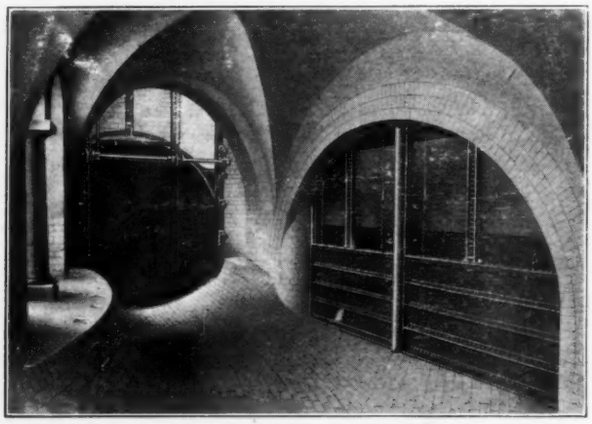

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PUBLIC WORKS.

CITY **COUNTY** **STATE**

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
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Vol. 51 **OCTOBER 22, 1921** **No. 17**

Constructing Sherman Island Dam

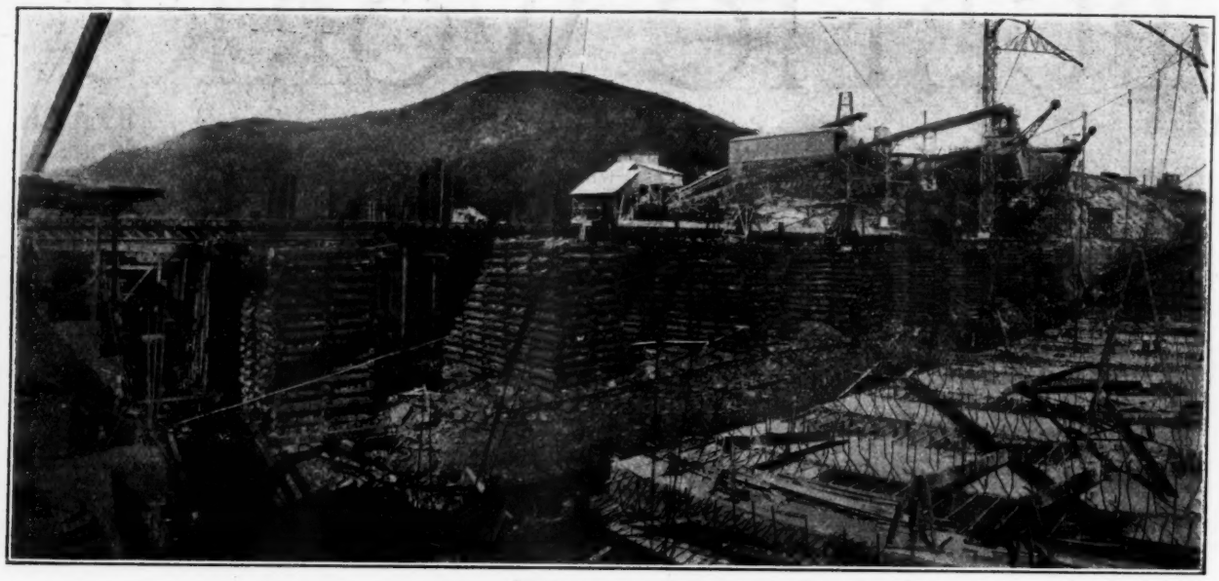
Unusually complete plant for constructing a multiple-arch dam on the Upper Hudson river. Concrete materials brought to mixer by belt conveyors and automatically proportioned by weightand entire mixing process operated by one man and distributed by another.

A power development consisting of a dam, canal, power house, etc., known as the Sherman Island development, is being constructed in the Hudson river about five miles above Glens Falls, N. Y., for the International Paper Co. by the Parklap Construction Co., of New York City, of which the firm of Parsons, Klapp, Brinckerhoff and Douglas are engineers and managers. The construction work has gotten well under way on the dam and canal and in this as well as in the design there are several features of unusual interest; chief among the latter being the spillway, while the construction features are notable even at this day for the minimizing of the use of common labor by adopting the latest labor-saving devices.

The development comprises a dam across the river, a power canal about 3,500 feet long with its headworks at the north end of the dam, and, at its lower end, a forebay, connected through 18-foot diameter penstocks to a power house for developing 50,000 h. p. This development will utilize practically all of the head still available in the river between an existing dam known as Spier's Falls about 3½ miles above, and the "feeder dam" which the state constructed in connection with the Glens Falls feeder of the Erie canal about the same distance below, this head being about 65 feet. About 20 feet of this available head is due to rapids in the river below the dam, which was the chief reason for locating the power house about 3,500 feet below the dam. The stream carries many millions of logs every spring for the use of the paper and lumber mills at Glens Falls and vicinity and provision had to be made for passing these logs over or around the dam and also during the construction of it.

The bed of the river contains boulders of all sizes to a depth of ten to twenty feet, and below this lie sand and gravel to a depth so great that it seemed impracticable to carry the dam to a rock foundation. The design adopted consisted of a multiple-arch dam about 600 feet long containing 29 full arches 19-foot span between centers and several fractional arches at the ends. The buttresses supporting the arches are themselves supported on a reinforced concrete floor slab placed on the boulder and gravel bed of the river, which was merely leveled off a foot or two below the original river bottom. The arched deck of the dam has a slope of 5 on 12 for about two-thirds its width and about 45 degrees for the upper third. The buttresses are 3 feet 6 inches thick and the arches from 18 inches at the top to 24 inches at the bottom. The total width of the dam is 104 feet, and an apron has been constructed for an additional 50 feet below the dam. In order to create additional safety against movement down stream, an anchor trench was excavated near the center line of the dam extending entirely across the river and filled with concrete cast monolithic with the floor slab and tied to it by reinforcement. The floor, buttresses and deck are all reinforced and thoroughly bonded together. In order to prevent seepage through the boulders and sand under the dam, interlocking steel sheet piles 55 feet long were driven at the upstream toe of the dam. A trench was dug along the line of the piles and filled with concrete, which is monolithic with the floor slab.

It is not intended that the dam should ever act as a weir dam, but provision for discharging surplus water not used in the power canal and floods was made by a spillway at the south end of the dam, where there is solid ledge rock for a considerable distance both above and below the dam and extending nearly to the spillway elevation. A spillway built in the line of the dam continued would have been much too short and the topographical conditions seemed best to be met by a spillway having in plan somewhat the shape of a hairpin with the loop upstream from the dam, the two legs of which are 180 feet apart and the entire length of crest about 950 feet. In the space between the two legs of the hairpin and extending



GENERAL VIEW OF INSIDE OF COFFERDAM, LOOKING FROM

At the right and left are seen the cribs that carry the industrial tracks and against which the sheet piling is braced. In tower, bins and mixer, excavation for north end of dam and entrance to canal. In the bottom background is a form, anchoring the buttresses. These floor strips are really straight,

downstream to the river is a channel excavated in solid ledge rock.

It is estimated that to carry the maximum flood waters of the river will require a head of 9 feet on the spillway and the velocity flowing over it will reach 38 feet per second.

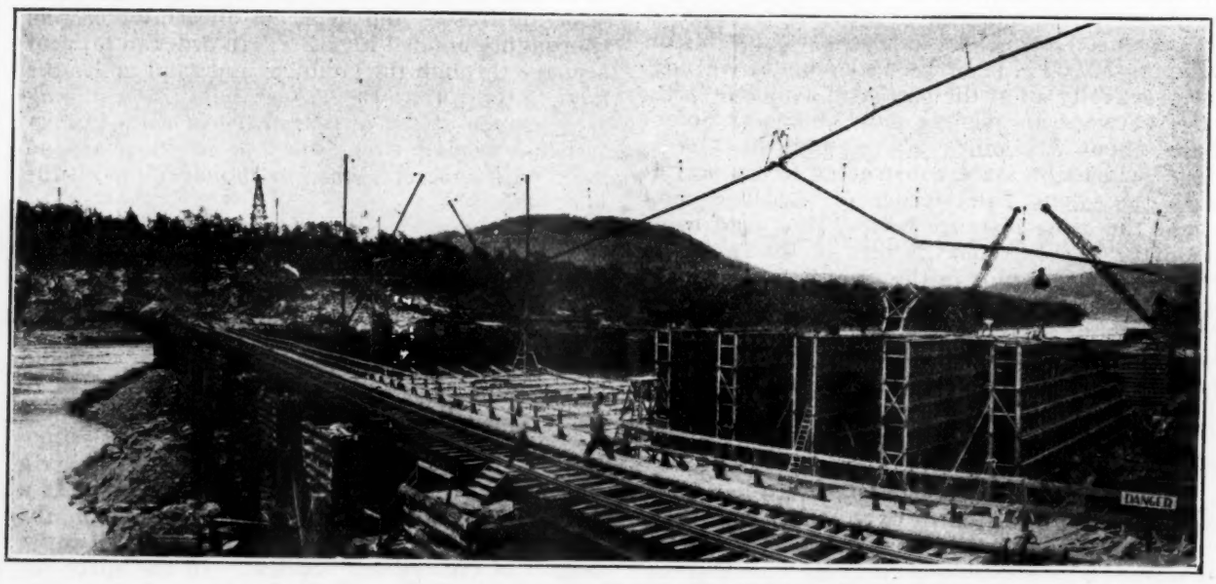
During freshets practically all of the logs in the river will pass over this spillway. At other times they pass through the power canal, provision being made at the lower end, just beyond the forebay, for discharging the logs into the river below the power house.

This canal also is unusual in that it is about 3,500 feet long, about 40 feet deep, 30 feet wide on the bottom and 150 feet wide on top and is built throughout in sand, paralleling and only a short distance from the river and 40 to 60 feet above it. The treatment of this canal so as to prevent seepage and wash and the destruction of the lining by logs passing through the canal and meet other difficulties forms one of the interesting problems of this work.

The entire development has been undergoing investigation by the International Paper Company's engineers for several years past, and some of the details are still being perfected as the construction progresses.

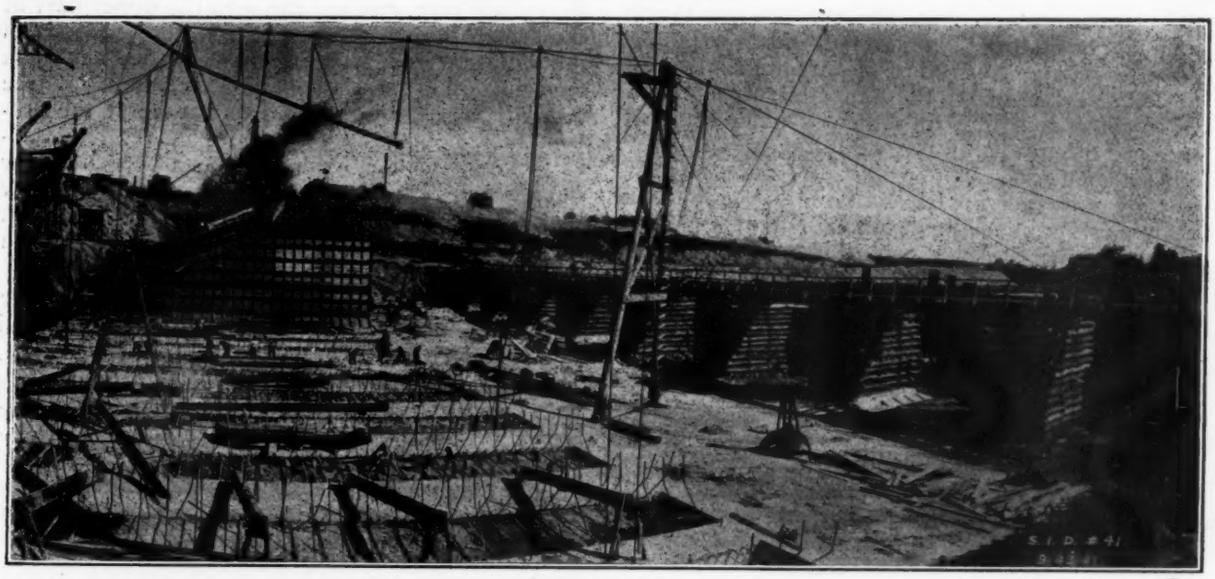
The power house, together with the canal, has been designed for the development of 50,000 h. p., although it is probable that mechanical installation for only 30,000 will be installed at first.

The dam is being constructed in two sections consecutively, each in a cofferdam enclosing half the width of the river. The north section is now



GENERAL VIEW OF DAM CONSTRUCTION, LOOKING

Construction track in foreground, paralleled by compressed air pipe. Rock excavation for spillway at left background. chutes extend over center of cofferdam. The inclined belt conveyer leads to top of stone bin. At the right of bins Against the hill as background is seen the

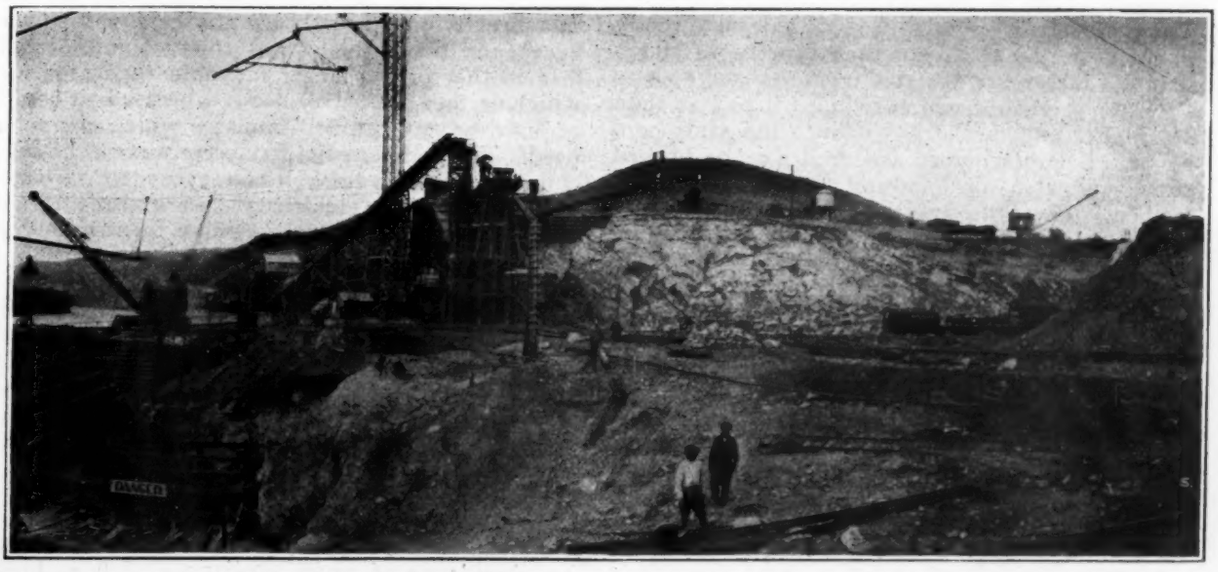


SOUTH WALL OF COFFERDAM TOWARD NORTH END OF DAM

the background are seen from the left to right, the crusher building, cement house, crushed stone conveyer, concrete nearly completed, for one of the buttresses and in front the strips of flooring between buttresses and reinforcement for but are made to look curved by the panoramic camera.

under construction while the southern half of the river channel carries the flow. Openings will be left in the dam so that, while the southern half of the dam is under construction, the flow of the river can be carried through the northern half; these openings to be finally closed at the completion of the construction. The north cofferdam, 250 feet wide by 340 feet long, was constructed by sinking 14 cribs in each of two parallel lines across the river, these being loaded with stone and sunk onto the river bottom, and six similar cribs across the end of the cofferdam. The two lines of cribs were extended entirely across the river to the further bank and served as support for two lines of track, each connecting the two sides of the river and used by the industrial cars bringing to the north side the stone excavated on the south, as well as for carrying the pile drivers, locomotive cranes and other equipment used for assembling and driving the sheet piling and later for handling the forms and other materials.

Lackawanna steel sheet piles were then driven 15 to 20 feet deep along both sides and the end of the cofferdam by means of McKiernan-Terry air-hammer pile drivers using 5,500-pound hammers. This secured a tight cofferdam with very little leakage except at one point in the end of the cofferdam where at first there was some inflow, but this was easily handled by two 8-inch centrifugal pumps and even this leakage was later reduced to practically nothing. The bottom was then leveled off and the trenches for the three cut-off walls dug, one in the center and one under each toe, and the cut-off sheet piling driven at



UPSTREAM FROM NORTH BANK OF THE RIVER

Forms for five buttresses at the right. Cable tower in background and cable faintly seen at top of illustration. Concrete and mixers is the entrance to the canal, on the further bank of which is the track on which sand is brought to the mixer. conveyor for the crushed stone stock pile.

the upstream toe. These sheet piles were 55 feet long and each of the two hammers averaged about six piles a day. In driving they began at the middle of this section of the dam and worked both ways, thus avoiding the difficulty of joining two sections of sheet piling driven independently.

As considerable ice as well as logs must be carried by the river during construction, additional cribs were built in the southern half of the river channel above the dam, one directly above each of the cribs that carry the construction track over the open channel and connected to it by a boom. These upper cribs will receive the blows of floating logs and jams instead of having these threaten the stability of the piers that carry the track and that will later be used for constructing the cofferdam in the southern half of the river crossing.

Before and during these early operations, a line of standard gage track had been laid from Glens Falls to the site of the dam, about six miles, for bringing in materials and machinery; a 1,400-foot cableway had been erected on towers 125 feet high spanning the river on about the center line of the dam; and houses were constructed for the superintendents, foremen and laborers employed on the work. Also the necessary trestles, bins and other structures necessary for storing and handling the concrete materials, mixing them and delivering them to the dam were being put into place.

HANDLING CONCRETE MATERIALS

The appliances for handling the cement, sand and stone, for crushing the stone and mixing and delivering the concrete are unusually complete in their labor-saving devices.

Most of the stone is obtained from excavation in the ledge rock on the south side of the river, although a little is obtained at the north side where the dam ties into the ledge rock and at the excavation for the head-gates. This rock is brought in cars to a jaw crusher 12 by 24 inches, into which the rock is dumped directly. The crushed stone is discharged onto a conveyor which carries it either to a stock pile or directly to the stone bins; except that any stones larger than 2½ inches are diverted from the conveyor to a gyratory crusher which reduced it to less than 2½ inches and discharges it onto the same conveyor. Belt conveyors are used for the broken stone, and also for handling the cement as described later. One conveyor carries the stone to an elevation of about 70 feet above the ground, where it falls onto a stock pile. Another conveyor carries it to one or the other of two stone bins which are located immediately above the concrete mixers, these bins being kept full and the surplus from time to time going to the stock pile.

All of the sand used is obtained directly from the excavation of the canal and is brought in side-dump cars directly to a point just above the sand bins, which also are set just above the concrete mixers. The sand is discharged directly into these bins through a screen which removes the gravel.

The cement is brought by rail from Glens Falls in bulk in gondola cars provided with a covering to exclude rain, and are run into the upper part of the cement house, where they discharge into bins immediately under the track, each bin having a capacity of several carloads of cement. These bins are all in one line and terminate at the bottom in a hopper and swinging valve. Immediately under these hoppers travels a belt conveyor onto which cement is discharged from whichever bin is desired. This conveyor carries the cement to and discharges it into a cement bin above each mixer.

Immediately above each mixer and below the bins is a bucket which receives the stone, sand and cement necessary for one charge of its mixer. For proportioning the mix the contractors are using an appliance which has recently been patented for this purpose and which reduces the labor required for the entire charging of the mixer to one man. By means of adjustable counter weights, the swinging gate at the bottom of the sand bin hopper, which is opened by the operator by pulling a lever, is closed automatically as soon as the predetermined weight of sand has entered the bucket. The charge of broken stone is determined in the same way by the automatic closing of the gate when the desired amount of stone has entered the bucket, and the same with the cement. The charge being in the bucket, it is dumped into the mixer by pulling another lever, one man easily performing the entire operation.

The mixer discharges the concrete into a hopper, which in turn discharges it into a bucket at the foot of a tower 185 feet high, from which it is distributed by chutes which distribute the concrete over the entire area of the first cofferdam. When the southern half of the dam is being built, it is proposed to discharge the concrete into the bucket of a second or booster tower, from which a similar system of chutes will distribute it over the southern half of the dam.

OTHER EQUIPMENT

The contractors obtain abundance of electric current from the International Paper Co. and use this directly or indirectly for practically all power except the locomotive cranes, the locomotives and a few other of the larger movable apparatus for which neither electricity nor compressed air could be used advantageously and on which steam is used. The rock crusher, concrete mixer, the machinery operating the belt conveyors, etc., are operated directly by electricity, as are also the two large Sullivan compressors which furnish air for the pile drivers, drills and some of the other apparatus. The drilling on the south side, where the channel for the spillway is being excavated, is being done with "Cyclone" drills, which sink holes from 30 to 50 feet deep at the rate of about two feet per hour. These holes are charged just sufficiently to loosen the rock without throwing it, and it is further broken up by means of jackhammers and mud shots.

Adjacent to the compressor house is a machine shop equipped most completely with lathes, planers and other large machines, drill sharpeners and an abundance of small appliances such as hack saws, etc.

In excavating the canal a steam shovel cut was

first made to a depth of 8 to 10 feet, the material being loaded onto the cars of an industrial train which ran on a track along the edge of the canal bank. Below this depth the sand was removed by a drag-line excavator. The sides of the excavation are being left untrimmed, the final trimming to be done immediately before the lining is placed.

CONTRACTOR'S CAMP

The contractor's camp contains buildings for housing about 500 men, nearly, which number is now occupying them. One hundred or so are brought from Glens Falls each morning and returned at night by the railway spur used for bringing in materials. The superintendents and married foremen occupy separate houses. There is a commissary which has capacity for feeding 400 men at one time. Water is supplied to all the houses from a reservoir in the hills above the camp, where a mountain stream is impounded. All houses have not only running water but also bathing facilities for the workmen. All the buildings are provided with sewerage on the water carriage system and this is treated in a septic tank before being discharged into the river. The greater part of the lumber used in constructing the camp as well as part for the concrete forms, of which there are an enormous number, was prepared in a sawmill erected at the site of the dam.

Of the more than 600 men employed on the work only about one-third are common laborers, since the extensive use of labor-saving machinery has reduced the need of these to a minimum. This machinery, however, calls for mechanics and other skilled workmen and the larger part of the employees are of this class, engaged in operating locomotives, steam shovels, drills, pile drivers, concrete mixers, stone crushers, in the machine shop, sawmills and office.

The manager for the contractors is E. A. Little; G. Miller is the assistant superintendent; H. L. Muchemore is field designing engineer and Fred Enander is master mechanic.

Educating the Layman

By Allen H. Wright

It has been the idea of H. N. Savage, hydraulic engineer of the city of San Diego, Cal., during the work of constructing the several units of the municipal water conservation system, to inform the taxpayers as far as possible relative to the manner in which the public funds are expended and to offer in object lesson form ideas concerning the construction work.

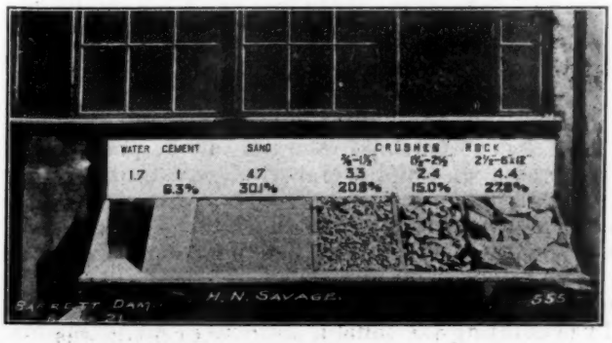


EXHIBIT SHOWING PROPORTIONS OF MATERIALS ENTERING INTO CONCRETE FOR DAM

At a recent fair held in the city of San Diego there was one simple exhibit, prepared by Mr. Savage, which told the layman unmistakably the proportion of each of the ingredients that are going into the construction of the big Barrett dam, now nearing completion.

This exhibit was so arranged that it showed to a precise percentage the amount of water, cement, sand and crushed rock which enter into the masonry of the dam, and the sections holding the crushed rock were divided into three bins, each containing the various sizes which are used. In giving the cubical contents of the several sections of the display, the amount of cement was used as the basis or 1, the water then showing 1.7, the sand 4.7, and the crushed rock 3.3, of ⅜ inch to 1½ inches, 2.4 units of 1½ inches to 2½ inches, and 4.4 of the largest sized rock, 2½ inches to 6 inches by 12 inches.

In public school work the object lesson has long been used to present a subject in a way which is understandable by all the pupils in the class, and similarly Mr. Savage's design carried his idea home to all who saw the exhibit.

Public Works in Pittsburgh

More than twenty-three million dollars to be spent on work now under way, contracted for or planned; largely streets, bridges and sewers.

Public improvements in Pittsburgh are being planned and executed on a large scale and their development is being vigorously accelerated, both to secure long needed construction, to stimulate general activity and to provide work for unemployed.

The Bureau of Engineering in the Department of Public Works is 100 per cent busy with plans, estimates and supervision of an unprecedented amount of work. A considerable amount of this is in the line of grade reductions, street widening, paving, boulevard construction and some bridge work, all of which involve a large amount of excavation and other work that can be done continuously throughout the year and provide occupation for many employees.

A total amount of $12,314,000, all of which is now under contract, is to be completed by the end of 1922. Some of this is well advanced and it is expected that $2,538,000 will be finished this year. About $942,000 of new construction contracts have been let within a very few weeks which include improvements of $90,000 for Baker street, $177,000 for Butler street, Morningside avenue and Manchester avenue, $255,000 for paving Saw Mill Run avenue, $270,000 for the Greenfield avenue bridge, $60,000 for the reconstruction of the North and Irwin avenue bridges, $90,000 for re-

pairs to the Highland avenue reservoir, $90,000 for repairs to the Island avenue bridge. Work will soon be started on the $777,000 widening and paving of Broad street.

Surveys, designs and estimates are now being made for the construction of the $801,000 West Washington boulevard, for a $351,000 street in Hazlewood to eliminate a grade crossing there, for a $255,000 new roadway on Arlington avenue and for a $210,000 bridge on East street. All of this work is in addition to work handled by city forces that include $1,167,000 for 14.5 miles of street reconstruction, $320,000 for 8.5 miles of new trunk line and collecting sewers, $150,000 for repairs and reconstruction of steel bridges, $580,000 for 345,000 yards of asphalt paving, equal to 22 miles of roadway 50 feet wide, and $76,000 for small contracts. Besides all this it is planned to spend $6,000,000 on the construction of a subway in the congested part of the city, although the plans and surveys have not yet been made and no commission has been appointed to undertake it.

Bids have just been invited for the construction of the Beechwood boulevard bridge over Forward avenue. This will be a reinforced concrete structure of the rib type. Estimated cost is approximately $250,000. Main span about 270 feet.

The commission appointed some time ago to consider the condition of the old eyebar type suspension bridge at the Point over the Monongahela river will shortly submit a report, and it is anticipated that a new structure will be required in this location and that work will shortly be begun on the plans. The estimated cost of this structure is approximately $2,000,000.

Some of the more important improvements now under way may be described briefly as follows:

East Ohio Street—Widening, regrading and reimprovement of East Ohio street, an important thoroughfare on the northerly side of the Allegheny river, approximately one mile in length. Estimated physical cost about $300,000, involving heavy retaining wall work, cutting back of houses and building a widened street between a steep hillside and main line tracks of the Pennsylvania railroad. Location necessitates maintenance of traffic during construction. Contractor, Thomas Cronin Company.

East Carson Street—Widening of roadway and of street, from South 7th street to the Smithfield street bridge. Sole main artery on the south side of the Monongahela river, carrying all through traffic from the business section to the outlying districts on the south side of the Monongahela river lying east of the Smithfield street bridge. Work consists of widening roadway for several hundred feet and increasing width of street. Contractor, M. O'Herron Company. Physical cost approximately $250,000.

Bigelow Boulevard—General improvements. A high-speed traffic street connecting the downtown business district with the large residential districts to the east. Large retaining wall contract at cost of $300,000 just completed. Grading of hillside under way. Slip which occurred on this boulevard in November, 1920, has been restored and the boulevard relocated at this point at an approximate cost of $150,000, involving placing of 20,000 cubic yards of slag fill and approximately $25,000 for sub-drainage in order to prevent repetition of landslide. Drainage sump at foot of slide near railroad just being completed. This sump is about 30 feet in length and 16 feet long and about 15 feet in depth. The sheeting and bracing is to be left in place and the sump filled with broken stone, except for inspection manholes, and the sub-surface drainage entering same through the bottom and through holes cut into the wooden side sheeting, is being drained through two 12-inch screw joint pipe lines which have been jacked through to the face of the slope from the sump. An improved illumination system consisting of an underground conduit and semi-ornamental lights carried on steel poles is just being installed throughout the entire 3-mile length of this boulevard.

Boulevard of the Allies—Contracts have just been awarded for the construction of the Boulevard of the Allies, a new high-speed arterial thoroughfare to extend up along the Monongahela bluffs and will supplement the present Bigelow boulevard which is now overtaxed. The new boulevard will serve what is known as the Oakland and Squirrel Hill sections of the city. Estimated cost of physical contracts $1,000,000. Estimated damages $1,000,000. Work consists of widening existing streets, making heavy hillside cut into rock in the bluff along the Monongahela river and reimprovement of existing streets, and also involves two viaducts aggregating 3,000 tons. Contracts have been awarded for the major part of this work. Various contracts have been awarded to the American Bridge Company, M. O'Herron Company, Thomas Cronin Company and Dravo Contracting Company.

Riverview Park Roadways—Concrete drive has just been completed in Riverview Park, this being the first park drive of this type constructed in this city and same has been built without contraction joints. The American Association of Cement Manufacturers co-operated with the city in the construction of this drive.

Highland Park Roadway—A reinforced concrete roadway through Highland Park and extending to the Washington boulevard is now being built. Same is a 40-foot roadway with 36 pounds reinforcement and is 8 inches thick in ground. No contraction joints.

S. M. Williams Resigns as Chairman of Federal Highway Council

In a letter dated October 8, S. M. Williams, chairman of the Federal Highway Council, Washington, D. C., announces, with regret, his resignation, due to personal interests, of the position as chairman of the Federal Highway Council and expresses his desire to keep in close touch with the highway situation throughout the country and to assist in highway development whenever possible.

For four years the Federal Highway Council has enjoyed the valuable services of Mr. Williams in the constant administrative and executive du-

ties of his office, which were performed without compensation. The present suspension of the work that he has supervised is complete unless perhaps some of various committees may be able to continue on other resources after the closing of his office.

Unanimous resolutions by the members of the executive committee accompanied the letter of resignation and testified to their unqualified appreciation of the valuable service rendered by Mr. Williams and their wish that the foundations so accurately laid by him should be built upon.

Street Cleaning in Philadelphia

As noted in these columns a few weeks ago, the city government of Philadelphia decided some time ago to begin next January the cleaning of the streets of the entire city by municipal forces under the supervision of the department of public works, following a year's experience in the cleaning of the large business section by the department. Certain local contractors have for years been performing this work, presumably at considerable profit, and are loathe to see it done by the city department and are, says Director Caven, throwing numerous monkey wrenches into the machinery through friendly councilmen or otherwise, which have seriously hampered him in preparing to take over this work on January 1. The director, however, asserts that he is more than ever determined to start city-wide cleaning of the streets on that date.

All the equipment necessary has either been bought or is being advertised for. A few days ago proposals were received for 14 to 35 5-ton trucks, for which bids ranged from $4,600 to $5,500 each; for 15 to 20 motor flushers, the bids for which ranged from $7,100 to $8,400 each; 10 to 30 motor-driven ash trucks, the bids for which were $3,600 to $6,100 each, and in addition, for tractors, snow plows and motor-driven street sweepers. Three hundred horses also were asked for, the lowest offer for these being at $137.50 each.

Director Caven has included in his plans the construction of three transfer stations where the ashes would be transferred from collecting wagons to other vehicles for removal to distant dumps. Stables and garages also would be located there. He also proposed to locate at these points incinerating plants for burning rubbish and garbage which would be provided with oil burners, so that, in case the rubbish is not sufficient to keep the temperature of the incinerators high enough to eliminate all odors, oil could be used for this purpose. The most serious difficulty which he has so far encountered has been caused by the refusal of the councilmen to accept any of the locations which he has proposed for these incinerator and transfer stations.

Refuse Incineration for Wilmington, Delaware

Capacity of present incinerator exceeded, and additional one, requiring garbage to be wrapped, and other changes recommended by John H. Gregory.

At Wilmington, Del., on August 15 of this year a refuse incinerator, specified to have a capacity of from 40 to 50 tons of average run garbage, trash, waste paper and dead animals per day, was put into the service of burning the garbage of the city and a part of the rubbish. The garbage is being collected under contract running three years beginning June 1, 1921, for which the contractor is to receive a total of $146,940. The rubbish is collected by the Street and Sewer Department of the city, as are also the ashes. Some of the rubbish is collected with the ashes and some of it is delivered to the incinerator to aid in burning the garbage.

The burning of the rubbish, however, does not provide enough heat to destroy the garbage and at the present time about five tons of coal a day are being burned for this purpose. The garbage is quite wet and, owing possibly to the limited amount of rubbish burned with it, the furnace is disposing of only about 36 tons a day, which appears to be approximately its capacity. As the population is estimated at 105,000, it seems probable that the total amount of garbage and rubbish is over 80 tons a day. It is quite evident that the present incinerator is by no means capable of disposing of all of the rubbish and some other provision for disposing of the remainder is imperative.

At the request of Mayor Leroy Harvey, Professor John H. Gregory has reported upon the subject, under date of September 26, and from this report the following facts and recommendations have been obtained.

PRESENT PROCEDURE

The garbage is required to be collected at least three times a week from June 1 to October 15 and at least twice a week during the remainder of the year. The garbage so collected is being taken to the incinerator and, as stated above, only about half of it is burned and the remainder is disposed of by dumping on ground nearby. The amount of garbage being burned is estimated at 26 tons and the combustible rubbish at 10 tons. The force employed at the incinerator consists of a superintendent and nine employees. The expense of operating the plant is now $7.50 a day for superintendent, $31.50 for labor and $36 for coal, a total of $75 a day or $2.08 per ton. Mr. Gregory states that the incinerator is new and is

not running to best advantage when handling wet garbage such as is delivered to it, nor is the most being made of the fuel value of the rubbish.

As illustrating what can be done in incinerating garbage when the latter has been drained and wrapped in paper (concerning which more later) he cites the case of Trenton, where the costs of incinerating garbage and rubbish for 1920 averaged $.09 a ton for superintendent and clerk, $.44 for labor, $.18 for coal and $.02 miscellaneous, or a total of $.73 a ton. Part of the salary of the superintendent and clerk is charged against collection, since they have charge of this as well as of incineration, but charging all of the superintendent's salary to incineration as is done in Wilmington would increase the cost to only $.80 per ton. In Trenton an average of a little over 50 tons a day is burned at the incinerator with about half as many men as are employed at the Wilmington plant.

RECOMMENDATIONS

Professor Gregory makes explicit recommendations for the treatment of the refuse disposal problem in Wilmington, accompanying them by a clear and concise explanation of his reasons therefor. He recommends that the householders be required to thoroughly drain the garbage and wrap it in substantial paper and deposit it in this form in suitable receptacles for collection; that combustible rubbish be fastened together by tying or otherwise; and that this and wrapped garbage be collected together in one set of wagons three times a week throughout the year and be disposed of by incineration, utilizing the existing incinerator to its capacity and building an additional incinerator immediately adjacent to it, the new incinerator to have a capacity of not less than 50 tons of wrapped garbage and rubbish per 24 hours. The new incinerator should have a combustion chamber and a high masonry chimney, neither of which are found in the present incinerator. He recommends that arrangement be made with the present contractor for a financial adjustment whereby he will collect both garbage and combustible rubbish and that, on the termination of the contract with him, such material be collected by city employees with city-owned equipment; the collection and disposal both to be placed under the control of a single superintendent with headquarters at the incinerator. Accurate records should be kept covering the cost and other details of the collection and disposal of the mixed garbage and rubbish.

As to the other refuse, the city should continue to collect ashes by city employees and dispose of them by dumping on low land, the dumps to be kept properly trimmed, in sanitary condition, and the tops covered with clean ashes, this including any private dumps as well as the municipal dumps. Privately owned and operated dumps should be under municipal supervision and control, and all scavengers removing and disposing of material other than garbage and combustible rubbish should be licensed and under municipal control. No garbage or combustible rubbish should be permitted to be disposed of at any dump, and no fires should be permitted at any dump whether privately owned and operated or owned and operated by the city.

DRAINING AND WRAPPING GARBAGE

Explaining his recommendation that the garbage be wrapped, Professor Gregory reports that "it is simpler, easier and less expensive to operate an incinerator burning a mixture of garbage and combustible rubbish where the garbage has first been drained of its free water and then wrapped in paper, than an incinerator burning simply wet garbage either with or without the burning of the rubbish."

"The draining and wrapping of garbage is not new and has many advantages, not only from the standpoint of disposal but also from that of the householder. Among these advantages may be mentioned, especially, the practical elimination of garbage odors on the premises; the elimination of the fly nuisance, as flies breed in garbage if the same is accessible to them; the ability to tranport the material in wagons through the streets without causing offense to passers-by; and the greater ease and economy in disposing of the material by incineration.

"One of the very best examples of the draining and wrapping of garbage, its collection with the combustible rubbish, and the disposal of both by incineration is the city of Trenton, N. J., population about 120,000, where this method of collection and disposal is in use and has been practiced very satisfactorily and economically for the last ten years."

"With a change from the present method of collecting wet garbage and dry rubbish separately to that of requiring the garbage to be drained and wrapped and collected with the combustible rubbish, I see no reason why the cost of incineration at Wilmington should not be very materially decreased and approach, if not equal, that at Trenton."

Concerning municipal collection, he says that "the householder will receive better service than when the work is done by contract."

METHODS OF DISPOSAL

In the report, the various methods of disposing of refuse are discussed and compared. Concerning feeding to hogs he says: "Some revenue may be derived from the sale of garbage-fed hogs, but feeding to hogs is, however, advantageous only where the conditions are such that the food value of the garbage can be safely guarded and maintained and where sanitary conditions can be maintained at the hog farm. These conditions generally exclude it from adoption in cities of any size, and but few cities having a population of over 50,000 have found the method satisfactory."

Relative to dumping garbage, trench burial, plowing into the soil and dumping into large volumes of water, he cites the objections for adoption by large cities that are familiar to those who have informed themselves on the subject.

Concerning reduction, the report states: "From a financial standpoint, no matter whether the reduction works are privately or municipally owned, it means entering the commercial field and in

competition with other similar plants. The works themselves are expensive to build and operate, and unless the grease and tankage can be sold at good prices and a financial return thereby derived, the cost is prohibitive. At the present time the price of grease is low and tankage is almost a drug in the market. How long this condition will last it is impossible to predict. One works which I have in mind is having great difficulty in selling its grease, even at a low price, and it is impossible to sell tankage, the latter simply being taken out on the lot and dumped on the ground. It doesn't pay at present at these works to recover the grease from this tankage by the naphtha process and the evaporators are not in operation.

"With a continued high cost of labor and material, it is not probable that reduction works can be operated, even with the sale of grease and tankage therefrom, other than at a loss."

Discussing the disposal of rubbish, he states that dumping is generally satisfactory provided the materials will not cause future trouble and if sufficient land is available. But fires are frequently started and the odors produced by them are often quite offensive, in addition to which the fire may be a source of considerable annoyance and even danger. Dumps containing rubbish have been known to stay on fire below the surface for days and any buildings on or immediately adjacent to the dumps may be endangered. "It is a serious question whether a municipality should allow the disposal of combustible rubbish on dumps, either publicly or privately owned, on which, even in the more or less remote future, buildings are liable to be erected." Moreover, a rubbish dump affords a good breeding place for rats and vermin and the wind may scatter disease germs brought to it in sweepings and other materials from sick-rooms. Incineration is the most sanitary method of disposing of rubbish.

Maintenance Of Sand-Clay Roads

Methods employed at Southampton, N. Y., for utilizing bituminous materials for this purpose. Three different methods, depending upon the condition of the road.

It would not be economically wise for localities which have large mileages of sand-clay roads to attempt replacing all these roads with the higher types of surfaces. In fact, it would be a financial impossibility. The construction of higher types has to come along gradually, and in the meantime the maintenance of the lower types must continue. These less durable types, when properly maintained, however, offer splendid wearing surfaces for automobile and light truck traffic.

Many localities lack suitable stone for road construction, and in a large number of these places the cost of importation of stone is prohibitive. It is necessary, therefore, to use local materials, which, when properly mixed, will make a suitable surface for the traffic it is to bear. But in the case of many classes of roads using local materials, a system of continuous maintenance must be employed to insure their usefulness to the community.

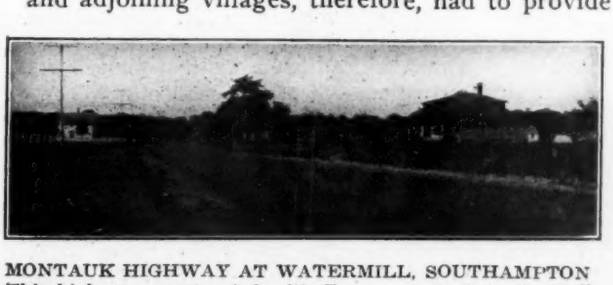
An illustration of this is found in the town of Southampton, Suffolk county, New York. For many years Southampton has been the summer social mecca around New York. Southampton and adjoining villages, therefore, had to provide means of communication for pleasure travel and light trucking.

Confronted by the total lack of local stone and the impracticability of importing it, the authorities of Southampton turned to such materials as were locally available, and used them in maintaining their sand-clay roads in excellent condition.

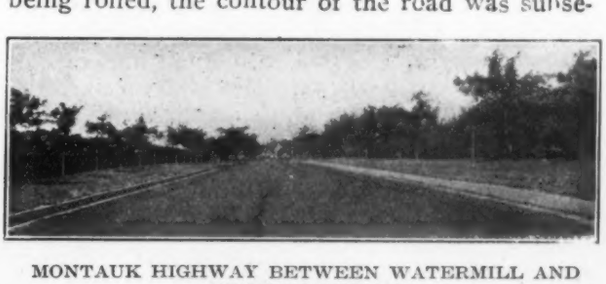
After extensive investigation and experiment, it was found that a mixture of 80 per cent of the coarse sand found in large deposits in the vicinity, with 20 per cent of the top soil loam, would make an excellent mixture for road construction. Fortunately, the beach sand which forms the subsoil of most of that section of Long Island provides excellent drainage for the foundation, without requiring additional work except for occasional cross ditches in heavy cuts.

BUILDING HIGHWAY SYSTEM

So eight years ago a system of highways was constructed throughout the town. After the sand sub-grade had been properly graded to width, the gravelly sand and loam were hauled and deposited in place and mixed by means of harrows. After being rolled, the contour of the road was subse-



MONTAUK HIGHWAY AT WATERMILL, SOUTHAMPTON
This highway was treated with Texaco road oil in the Fall of 1919



MONTAUK HIGHWAY BETWEEN WATERMILL AND BRIDGEHAMPTON

quently maintained by the systematic use of horse-drawn blade graders which threw the loose material from the sides into the depressions formed by the traffic on the crown of the road.

About the time of the construction of these roads, the use of automobiles in that territory began to increase in remarkable numbers so that some means had to be taken to maintain the surface, which would be rapidly scattered to the gutters by the passing machines. This characteristic of the roads is particularly noticeable in sections which are not so well maintained because of the light traffic they have to bear.

To maintain the surface, a system of oiling with cold asphaltic oil was adopted in practically all the towns of Long Island, Southampton being the pioneer. The open surface of the road readily absorbed the asphaltic oil, but left numerous puddles in the depressions where greater compression had been caused by traffic. By filling the depressions with scrapings from the elevations, a uniform surface was obtained.

THREE OILING METHODS USED

As the traffic increased and experience was gained in the use of oil for maintenance, three methods were developed, their use depending on the condition of the road.

The first method used was when the road surface had not been previously treated or where excessive traffic had destroyed its contour. In such cases the contour was restored by grading the loose top surface to the sides of the road. This partially fills up the deeper ruts along the shoulders and provides material for covering the oil after it is applied. Oil containing from 50 to 60 per cent of asphalt is applied by horse-drawn pressure distributor at the rate of about ¼ gallon per square yard. Instead of shoveling the top dressing back over the road, the grader is reversed and the material in the gutters is thinly graded back over the oil in several trips so that each successive trip completely fills up any depressions created by the traffic after the oil has been supplied. This permits the oil to dry out slowly and maintains the contour so that when complete evaporation is attained and the surface is hard as the oil will permit, the contour of the road is practically perfect.

Another method is used when the road has been so maintained that the oil surface is good, covering practically the entire roadway, and the contour is perfect except for isolated depressions. Then the road is not swept or graded before the application of the oil. The character of the surface prevents any accumulation of dust, so that when the oil is applied it adheres to practically the entire area. In this case small amounts of coarse sand are distributed by shovels over the surface to take up a part of the oil, which is distributed at the rate of ¼ gallon per square yard. The sand is not spread, however, so as to completely take it up and prevent the revivification of the old surface.

Where grooves occur in the road, patching is accomplished by a mixture of sand and cold oil. This is troweled in somewhat after the manner of applying a mastic.

The third method employed is when, as the result of the continuous application of cold oil for a number of years and covering with sand, the surface of the road becomes a mat about 1 inch thick; and when, from excessive traffic or other circumstances, it becomes somewhat roughened or the contour is destroyed beyond the possibility of repair by the other two methods.

In such cases the entire surface is scarified by means of plows or scarifiers to the depth of 3 inches and harrowed in place. This rough surface is then graded to the proper contour with blade graders, rolled with a steam roller and oiled at the rate of ¼ gallon per square yard. The oil is covered, as in the first method, by grading up from the drainage gutters excess material from the old road.

To take off the water from the surface of the roads where there is practically no side drainage or the road is level, a series of deep holes are dug a short distance off the side of the road down to the sub-grade so as to permit surface water to drain off rapidly.

Repairing French Roads

It is reported that the French government has improved 13,620 miles of the 33,000 miles of roads in that country which were in need of repair at the close of the war, and that 2,200 miles have been completely reconstructed with durable pavement. In doing this work the government has adopted the policy of open competition between various types of construction with a view to testing out such standard constructions as concrete base with asphalt surface, bituminous base with asphalt surface, waterbound macadam with bituminous surface, etc.

Distilled Water for Toledo Water Works Power Plant

The Department of Public Service of Toledo has decided that the water furnished by the public water works plant is not good enough for its own use, and contracted in September for a Griscom-Russell distilling plant to be used in obtaining pure water for the boilers at the Broadway pumping station of the water works at a cost of about $10,000. This is the first plant of this kind to be installed in Toledo. It is estimated that the cost will be returned to the city in two years in the saving that it will effect in fuel consumption and cost of cleaning boilers and making repairs by the elimination of scale in the boilers.

Advises Reducing Drainage Work

At the Drainage Congress in St. Paul a few days ago, S. H. McCrory, engineer of the Department of Agriculture, advised against beginning new drainage projects of any magnitude for the next few years, since utilization of lands already drained has not kept pace with reclamation work. The present low prices of farm products and the general business depression have tended to decrease temporarily the demand for such lands and Mr. McCrory advised therefore that new work should be undertaken only where there is a definite demand for the land and a strong assurance that it will be put to agricultural use.

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Good Roads and the Railroad Strike

Should the threatened railroad strike take place, it is probable that the public will receive a striking demonstration of the direct value to it of good roads for other than joy riding purposes. For plans are under way for calling into service 100,000 or more trucks for keeping cities supplied with food; and without fairly good roads into all the farming districts surrounding each city, these trucks could not be used to advantage. In fact, it is doubtful if the million trucks in service in this country would have been built had not the construction of good roads progressed as generally and rapidly as it has.

Assuming that the truck capacity of the country averages two tons, with each truck making an average of one trip a day in covering an area of 150 miles around each city, 100,000 trucks could bring in each day eight pounds for each of the fifty million residents of cities, which is at least twice the average amount of food required. It would, in fact, be ample for all private needs except fuel. As for transporting raw and manufactured products to keep the various industries going, much can be done in this also by use of motor trucks.

Should railroad transportation be seriously restricted, there seems to be little doubt that the highways on which so many millions have been spent will justify that expenditure for such emergency purposes alone.

Labor-Saving Devices on Public Work

The elimination of common labor in concrete construction would seem to have been carried to almost the limit in the dam construction described in this issue. It would appear that only seven men are employed in crushing the stone, transporting the stone from the crusher and the sand and cement from the cars to the mixers, operating two large mixers and distributing the concrete to the forms at the rate of more than 500 cubic yards a day; except for the one or two men needed to keep the motors in repair, the conveyors operating, etc.

In this case labor is rather scarce and refuses to take reductions in wages, and "labor troubles" threaten all kinds of large public work. On the other hand, it was stated in the October 1 issue of PUBLIC WORKS that in Martinsville, Va., labor-saving devices are being used to a less extent now than during the previous year or two because labor has become abundant and cheap. These two cases tell the story. Labor-saving machinery costs money for purchase, operation, maintenance, depreciation, storage, transportation, etc., and when this total overbalances the total cost of labor, both direct and indirect, labor will be given the preference.

But in estimating the relative costs, the indirect costs of labor should not be overlooked. The chief of these are the overturn, and losses incidental to strikes, walkouts and other uncertainties as to the continuous maintenance of gangs of uniform size and satisfactory experience. A strike of a few days or weeks might easily cause a loss to a contractor in overhead, wages to retained but unoccupied foremen, interest or rental of plant, floods occuring after the date when the work could have been finished, and scores of other possibilities that would total much more than the cost of the machinery.

Almost any labor-saving device ceases to be money-saving when wages fall below a certain point. On the other hand, any satisfactorily operating device is money saving when wages rise beyond a certain height. Labor has it largely in its own hands to determine to what extent its demand for high wages and generally threatening attitude will lead to reduction of the number of laborers employed by the partial substitution of machinery.

There are other advantages of some machinery

besides those mentioned. It often is of such nature as to insure greater uniformity of product; for example, machine vs. hand mixing of concrete. The same machine is also an example of the greater speed attainable than would be practicable by hand labor alone, and speed can be translated into dollars and sometimes into large sums.

In addition to the advantage that can be figured in dollars, there is no doubt that many contractors consider mechanical substitutes for day labor desirable because of the greater freedom it gives them from the uncertainties of labor. Many contractors have felt, during recent months, that until a job is finished the labor problem is a sword of Damocles hanging over their head, and anything that strengthens the thread that suspends it will do much toward saving them from nervous prostration.

There is still another consideration that agrees for more general use of machinery that partially supplants day labor. Very little of such labor in this country is drawn from the children of immigrants, but most of it is foreign-born. Graduates of our public schools do not take kindly to pick and shovel but may to running excavating machines. But with the number of immigrants that will be admitted in the future limited to a fraction of those that entered annually before the war, when public work reaches normal dimensions again the pick and shovel men who die off or change their occupation will be only partly replaced, and the deficiency will naturally encourage if not necessitate the more extensive substitution of machinery.

All of which leads to the conclusion that the wide-awake, successful contractor must keep himself familiar with the labor-saving machinery available for his work, and carefully calculate, for each job, how much of it he can use to advantage.

Native and Foreign-Born Birth Rates

The matter of immigration has received considerable attention in this country during the past year and is being restricted by federal laws limiting the number to be admitted each month to a certain percentage of the present population of each nationality in the country. There is a fear, for which there is undoubtedly considerable foundation, that immigration to this country, if unrestricted, would bring in foreign blood and foreign ideas faster than they could be educated to American ideals or assimilated with the American population.

This danger would seem to be increased by another condition which tends to act in the same direction. This is the much higher birth rate of foreign-born residents in this country—that is, the recent immigrants—than of the native born, and especially those whose families have been in this country for several generations. The vital statistics for the year 1920 of Montclair, N. J., a suburb of New York, which contains a high percentage of families whose ancestors for several generations have been Americans, show that the birth rate of the foreign-born whites in the town (a large percentage of which are Italians, with a number of Slavs and a scattering of other European nations) is almost exactly seven times that of the native born whites, or 85.0 for the former as compared to 12.2 for the latter. Assuming that immigration was shut off entirely and that the tendency indicated by the above figures continued at a rate decreasing about, say, 25 per cent each generation, it would not be many years before the direct descendants of the present native-born population would be completely overwhelmed by those of the recently imported Europeans.

We make no attempt to draw any conclusions from this or to imply whether such result would be advantageous or otherwise; except to state that, if the present citizens of American ancestry are to see what they consider to be American ideals continued in this country, they must pay even greater attention to the education and training in American citizenship of the children of these foreign-born parents.

Wage Reductions

Recent advices report that there is prospect of immediate resumption of building in Pittsburgh after a four-year delay, caused by industrial disputes, unfavorable conditions, and unreasonably high wages. Considerable reductions have been made in the price of building materials, the unions and the contractors are desirous of resuming work and the carpenters' union, with about 4,500 local members has accepted a 25 per cent cut by subscribing to a two-year agreement for a $1.00 per hour wage. The other building trades are expected to fall in line with the carpenters in negotiations with their employers. It is claimed by different officials that builders have promised recognition of the union.

In Dallas, Texas, where a few weeks ago contractors, engineers, real estate men and others convened with the Chamber of Commerce and agreed to suspend all operations until the outrageous wages were reduced, the bricklayers, who were then receiving $12.00 a day and demanding more, are glad to accept $10.00 or less, carpenters have been reduced from $8.00 to $6.00 and common labor from $.50 to $.25 per hour.

Bricks which formerly cost $30.00 per 1,000 can now be purchased for $12.72 and the Open Shop Association, which never before advised the public to build, now states that the time is most favorable and urges the city of Dallas to take advantage of low prices, which may not continue indefinitely.

Highway Work In Wisconsin

It is reported that the entire highway construction program of the state of Wisconsin for the year will probably reach practical completion by November 1 and that it will be at least two years before another program as comprehensive as that of this year can be carried out. Nearly 350 miles of concrete highways, all but 80 miles from county bond issues, have been constructed. One thousand, five hundred miles of road, largely state trunk highways, has been given a gravel surface and 1,660 miles has been graded. About $24,000,000 has been spent on road construction during the year and $4,000,000 on maintenance. Only $15,000,000 will be available for road work next year.

Snow Removal In Pennsylvania

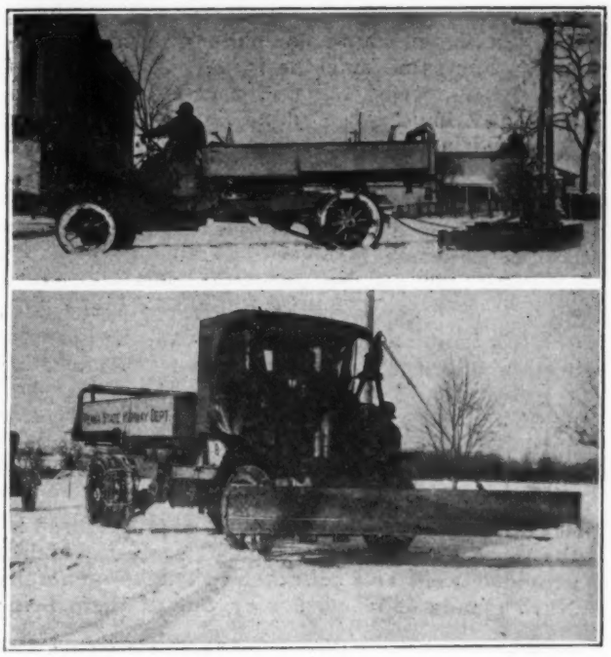
About 11,000 miles of primary roads to be kept free of snow during the coming winter by the State Highway Department. Snow removal on these roads last winter cost about $113,000.

Previous to the regulation of highway traffic to secure increased efficiency under the conditions developed during the war, no considerable effort had been made to maintain any large proportions of the Pennsylvania highway free from obstruction by snow.

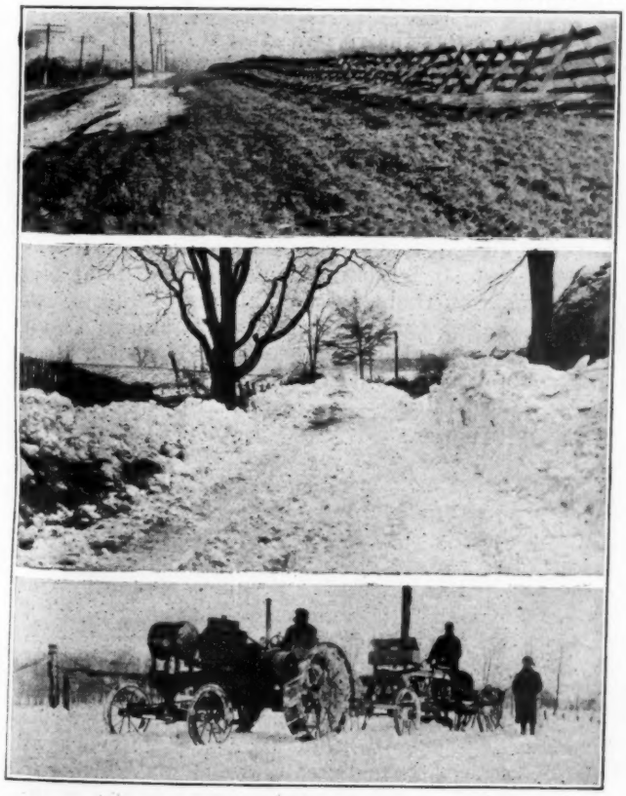
The state of Pennsylvania has about 100,000 miles of highways in level, hilly and mountainous country serving agricultural, mining, commercial and many manufacturing districts, including several large cities and a great number of smaller cities, towns and villages. Within a few years the state legislature has declared about 11,000 miles of these roads to be state roads, constructed, reconstructed and maintained by the State Highway Commission and forming a system which provides several north and south and east and west cross routes and interstate routes forming trunk lines for through freight and for the connection of the principal traffic centers of this state.

During the war the United States government inaugurated and developed the system of motor truck transportation of military supplies from the manufacturers to the seaboard by routes that traversed some of the most important highways in the state. While this traffic was maintained a system was worked out by the highway department in co-operation with the weather bureau and federal military officials, under which the highway department received daily reports from the weather bureau at Washington, which, in conjunction with other data available in the federal offices, permitted the development of a system by which it is now possible for the district engineers in the highway department to anticipate any meteorological requirements and to be prepared to cope with the probable snowfall by providing in advance sufficient horses and equipment to commence its removal as soon as the storm begins and to continue it day and night if necessary until the storm ends and the routes are satisfactorily cleared, which is accomplished with the regular machinery owned by the department and by an abundance of hand labor and teams that are thus maintained in readiness. The great importance of this work is indicated by the expenditure for it of $69,000 in 1918, $10,000 in 1919 (when the snowfall was very light and the weather mild), and $113,000 in 1920.

In general, as soon as the snow begins to fall its removal is vigorously commenced with snowplows operated by automobile trucks and by road machines and drags, generally pulled by trucks, but sometimes hauled by teams. Each day the numerous superintendents throughout the state receive reports from the United States weather bureau, which give the weather probabilities for each route and section. Each day the superintendents mail to the maintenance division in the head office of the State Highway Commission at Harrisburg a statement for each route and sec-



HAULING V-SHAPE WOODEN SCRAPER WITH TRUCK
TRUCK PUSHING REGULAR STEEL SCRAPER



WINDBREAK TO PROTECT HIGHWAY FROM SNOW DRIFTS
HEAVY SNOWFALL ON STATE ROAD
HANDLING ROAD MACHINE WITH TRACTOR TO CLEAR SNOW

tion, giving weather conditions (under headings of clear, cloudy, rain, snow, depth of snow), and road conditions (under headings of good, fair, poor, slippery or impassable). These are all posted on 16 x 11-inch loose leaf printed blanks having 35 horizontal record lines and headings with vertical rulings for county, route, section, location, weather conditions and road conditions and remarks. These data are transmitted to the extension bureau that furnishes valuable information based on them to the local newspapers.

Ordinarily the snow is first cleared for a width of 8 feet from end to end of the road, thus providing a single track with wider spaces for turnouts at intervals. The work is carried on day and night as long as the storm lasts, and afterwards until the required width is fully cleared, which is frequently simultaneous with the cessation of the snowfall.

The department has 41 plows manufactured by the Good Roads Machinery Co., each of which is provided with two automobile trucks, generally Nash Quads (4-wheel drive), one of them being used as an emergency reserve or to push in case of very heavy work being required. There are also available V-shaped plows drawn by horses or tractors, 288 road machines, mostly Champions, and 110 tractors. This equipment is generally distributed throughout the state and is available at points accessible for immediate use on the roads in the localities where it is required.

Record September Construction

Building contracts awarded during September in the 27 northeastern states are estimated in the F. W. Dodge Company's review to amount to $246,186,000, the largest monthly total of this year and the largest September figure on record. This is an increase of 11½ per cent over the August figure, which itself is ordinarily 14½ per cent less than the average September figure.

The greatest increase was in the New York district and the most significant feature was the increased volume of business building that represented 17 per cent of the total. Public works and utilities were 14 per cent of the total.

The San Antonio Flood

Unusual precipitation on saturated ground and river channel obstructed by bridge piling caused flooding of business section fifteen feet deep. Large areas of wood block pavement floated away.

San Antonio, Texas, has joined the list of those cities which, not having taken with sufficient seriousness previous warnings in the form of minor floods in the streams passing through them, have suffered disaster by an unusual flood. During the night of September 9 and 10 this city was visited by a flood which caused more than 50 deaths and covered the streets of a large part of the business section to depths up to 15 feet or more.

In 1914 there was a heavy flood which caused so much damage and inconvenience that steps were taken toward flood prevention and the engineering firm of Metcalf & Eddy, of Boston, made recommendations to this end. Some steps had been taken toward following out these recommendations but not much actual work had been done. Now, however, it is probable that active steps will be taken at once to prevent a recurrence of this year's disastrous flood.

The San Antonio river winds with a very circuitous course through the city, crossing numerous streets and spanned by 25 bridges within the city limits. Many of these bridges consisted of short wooden spans supported on piles and the presence of these undoubtedly added considerably to the volume of the flood, since large amounts of debris were held back by these pile bents with their comparatively narrow openings and these piled up the flood waters and caused them to overflow into the adjoining streets.

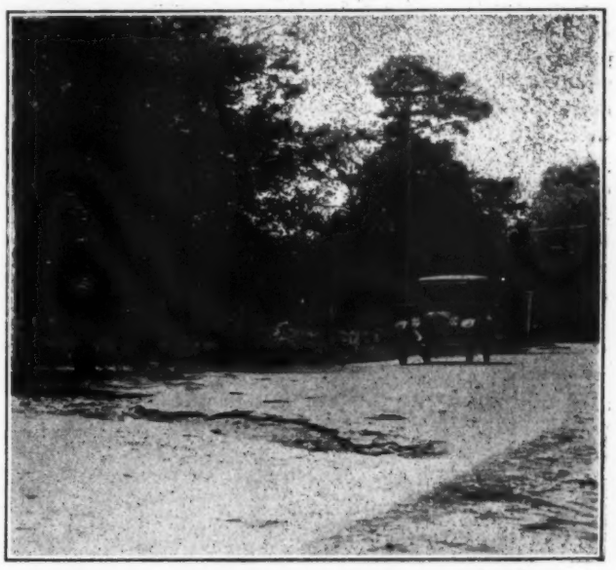
Just above the city the river is joined by a creek known as Olmos creek, while just below the city there enters the river a stream formed by the junction of the Alazan, the Martines, the Zarzamora and the San Pedro creeks, which all join a short distance from the discharge into the San Antonio river. Reports indicate that the height of the flood was due to floods coming from these several creeks into the river at just the successive periods necessary to produce maximum flood conditions, although the waters from the Olmos watershed appear to have been chiefly responsible. The floods on the several creeks were due to unusually heavy rainfalls following a storm which had already soaked the ground. Up to Friday night approximately 7.5 inches of rain had fallen in the city and the river was about 3 feet above its normal stage. Shortly after 8 o'clock that evening there was a heavy rainfall on the Olmos creek watershed estimated at 13 inches falling within two hours. This was the chief cause of the flood. By 11:30 the river was beginning to overflow its banks and by 2:45 in the morning of the 10th it had reached a height of 14 or 15 feet in some places. It then receded rapidly and by 7 o'clock all but a few of the lowest streets were above water.

The cleaning up of the flooded district was undertaken with energy, the army loaning the city a number of trucks to be used for this purpose, all of the city trucks ordinarily used for ash and garbage collection and otherwise being in use at the same time. By the end of a week this work was practically completed and the regular collection of

ashes and garbage was resumed. The soldiers of the 8th Corps, located at Fort Sam Houston, aided greatly in the work of restoring physical conditions as well as in maintaining order and preventing looting, and assistance was of course rendered by contractors and all others having men or vehicles available. Although the citizens had suffered considerable loss because of the flood, outside help was declined and the city made an appropriation for reconstructing streets and also for carrying out the plans for prevention of a recurrence of the disaster.

One feature which is peculiar to this flood was the destruction of the streets, which demanded the immediate expenditure of a quarter of a million dollars for restoring traffic even after the flood debris had been removed. A considerable part of the paving in the business district had been wood blocks. A local paper issued the day before the flood stated that many of the wood block streets were bulging in spots because of the swelling of the blocks following the heavy rain of the several days previous, and the city engineer proposed to give these blocks a heavy dose of oil as soon as they dried out. The flood water, however, got under the blocks and a large percentage of them were lifted from the base and washed away, some of them to farms below the city, but most of them were carried comparatively short distances. A great many of them were washed into the sewers, some of them into house sewers as well as the storm sewers, and considerable trouble was experienced in remedying the stoppages caused thereby.

This condition made it necessary to begin immediately the reconstruction of the pavements. Out of a total of 155,000 square yards of creosoted wood block pavement, the city engineer reported that 57,665 square yards had been absolutely



QUEEN ANNE COURT, SHOWING ROCK ASPHALT PAVEMENT TORN UP BY LIGHTNING

washed away. A small part of this total area consisted of small patches which could be relaid, using blocks which were salvaged from various points; but it was decided to relay at once 45,850 square yards with some material other than wood block, bituminous surfaces being selected. City Engineer D. D. Harrigan planned to let contracts for this paving at once and have three shifts of men working day and night, which would permit completion of the work in 30 days, he thought. The plan was to utilize the concrete base of the old wood block pavement and on this lay a 2½-inch bituminous concrete base and on this a 2-inch bituminous wearing surface. On September 22, contracts were made with the Southwestern

WEST COMMERCE STREET ON THE MORNING AFTER THE FLOOD
Water had covered street two feet deep. Wood blocks seen in background washed up into high pile, and scattered over the street

Bitulithic Co. for 31,400 square yards of the new pavement and with the Uvalde Co. tor 14,450 square yards. The Bitulithic company agreed to lay a 2-inch Warrenite-bitulithic surface on a 2½-inch bituminous concrete base at $2.50 per square yard, which was $.55 below the price formerly charged. The Uvalde Co. contracted for $2.55 a square yard, which was its former price. Arrangements were made with the property owners for paying two-thirds of the cost of the new pavement, estimated at $250,000. A considerable amount will be borne by the San Antonio Public Service Corporation, while the balance, estimated at about $60,000, will be paid by the city.

Aside from the destruction of the wood block pavements, little damage was done to the streets. One brick street was slightly damaged but none of the bituminous pavements were disturbed. Some of these bituminous pavements were on macadam base and some on concrete. One of the latter was under ten feet of water and the force of the flood swept away the concrete railings of a bridge close by and carried one house into the middle of the street, but did no damage to the pavement.

It is not the purpose of a wood block pavement to withstand a flood, and the fact that these blocks were floated away is no disparagement of them as a pavement wearing surface; but there are some cities or sections of cities which are subject to occasional floods, and this is by no means the first time that wood block pavements have been removed from flooded streets. So far as we recall, however, this is the most extensive removal of creosoted wood block by floods that has come to our notice. In view of this possibility, it would seem to be a wise precaution to avoid the use of such blocks as paving material at any points liable to flooding.

Attention is also called to the important part played by obstructions in the river occasioned by the pile supports of several of the bridges. Had not twelve of these bridges been washed away the flood would probably have risen higher and lasted longer. Most floods in every stream bring down large quantities of floating debris, such as trees, lumber, small buildings and the like, and anything which holds back these materials and allows them to pile up, especially in a shallow stream, is sure to add to the damage done by the flood by causing it to back up and find its way around the ends of the bridge, through the adjacent streets of the city. Piers or other stream obstructions should be eliminated or reduced to the least possible number, and those necessarily present should be designed to offer the least possible obstruction to water and floating debris.

For the details given above and the illustrations we are indebted to F. E. Rightor, M. Am. Soc., C. E., president of the Southwest Bitulithic Co.

TRAVIS STREET AFTER FLOOD HAD SUBSIDED
High water reached the awnings at the right, indicated by the words "Water line."

Progress of Federal Aid Work

The month of June, which is the latest for which official figures are yet obtainable, was a record month in the construction of federal aid highways. Projects previously under way were completed during that month that had a total length of more than 1,200 miles—more than twice the amount completed during the month of May. During the fiscal year ending June 30 the total of completed projects had increased from 1,677 miles to 7,469, while projects under construction had increased from 14,940 to 17,977. The total amount of federal aid to which the states had become entitled through completion of work had increased from $40,097,881 to $118,915,515. The amount o increase during the year was nearly twice as much as during the four preceding years combined. These figures refer to projects completed, and not to amounts of work done, the former being used by the Bureau of Public Roads as the basis for its records.

In addition to the larger sum mentioned above, $66,375,636 has been allotted to the several states but not yet earned by the completion of the projects. There also remains $18,793,544 not obligated on June 1. Of the more than $66,000,000 allotted but not yet paid out, not all is available for future work, a large part of it having really been earned by the states but not yet received because the projects for which they are to be paid have not been completed. For instance, New York state was allotted $13,420,508 but on June 30 had completed projects calling for only $133,673, apparently leaving over $13,000,000 still to be earned. A considerable part of this, however, is to be applied to projects which have been under construction for some time and some of which may have been completed since June 30. However, in this as in many other states there is yet a large amount of uncompleted work and the unemployment emergency will probably lead to a speeding up of this and a continuation of it through the winter so far as possible.

Handling Liquid Chlorine

By D. K. Bartlett†

Explanation of its characteristics and the precautions that should be taken in handling and storing it.

Chlorine in liquid form has now been used in this country since 1907. In common with all other compressed gases there are very definite and careful regulations drawn by the I. C. C. governing its transportation. Under these regulations there are four accepted containers in which the material may be moved, namely, those which cary 100 lbs., 150 lbs., 2000 lbs., and 30,000 lbs. As there have been no accidents in Interstate Commerce since the regulations have been in force it would seem proper to assume that the regulations are right, as they now stand.

The use of chlorine has become very widespread through the textile industry, the public water supply system, the flour industry, the chemical industry, and the pulp and paper industry. Liquid chlorine is today stored in from 4,000 to 5,000 different points in quantities of from a few cylinders to many thousand pounds. So far such regulations covering storage as have been in force are simply those recommended by the producer to the consumer. Safety is of prime importance to the producer as well as the consumer, and while the hazard is much less than is commonly supposed, it is, nevertheless, sufficient to cause the producers to adhere to and recommend regulations which make the use of this material safe.

It may be well at this point to consider briefly the hazards of compressed gases in general.

As long as the gas remains in the container, it is obvious that it can do no harm, irrespective of its effect when released. It is therefore necessary to consider the probability of escape of gas from the container, as well as the qualities of the gas itself. An escape of gas from a container may be due to—

A. A true explosion.

B. An increase of pressure, due to heat, sufficient to rupture the container.

C. Leaks.

If the gas escapes from the container, the resulting hazard may be due to—

1. Inflammability.

2. Poisonous effects.

3. Irritating effects, with interference with sight or respiration.

Considering now the specific case of chlorine, we can eliminate "A" since it is non-explosive. The chance of a rupture due to "B" is very slight on account of the high critical temperature of chlorine. The following table gives this temperature for a number of common gases:

Chlorine	146
Ammonia	132
Acetylene	36.5
Nitrous Oxide	36.5
Carbon Dioxide	31
Oxygen	-118
Hydrogen	-240

By I. C. C. regulations all cylinders and ton drums are provided with fusible plugs which melt at 158 deg. Fahrenheit, at which temperature the pressure is about half the test pressure of ton drums at time of manufacture and a quarter of the test pressure of the smaller cylinders.

There has never been an instance of bursting of a container in transit, or in a user's plant.

There have been four or five cases of the rupture of containers in the manufacturer's plant due to the presence of foreign material in the container which reacted with the chlorine. To guard against repetition of such accidents, all manufacturers now have in force a rigid system of inspection of empty containers. Even should a container with such foreign material be filled, any trouble resulting will necessarily develop within a few hours, so that any hazard existing from this cause concerns only the manufacturer—not the user or the carrier.

There have also been a few cases of fire where a large quantity of chlorine has been stored. In each case the upward draft due to the heat of conflagration has been strong enough to carry the gas upward and cause a sufficient dilution so that the fire fighters were caused no inconvenience in their work.

This brings us to leaks. Here the evil smell of chlorine is its own greatest safety factor. Its presence in the atmosphere can be detected in very minute quantities through the sense of smell. After the person in charge of the use of the chlorine in any plant has had his first considerable whiff, he is quite ready—from then on—to exercise reasonable care, take necessary precautions, and follow the instructions laid down by the manufacturer.

The next safety factor is the slow absorption of the heat necessary to evaporate the liquid into a gas. The following table gives the rise of temperature of the liquid chlorine in a tank car during a period of 96 hours:

Time	*Temp. Contents*	*Change during period*	*Pressure*	*Change during Period*
(Start)	(—9 deg. C.)	—	(64 lbs.)	—
End 24 hrs.	—2 deg. C.	7 deg. C.	76 lbs.	12 lbs.
End 48 hrs.	+3.5 deg. C.	5.5 deg. C.	88 lbs.	12 lbs.
End 74 hrs.	+6 deg. C.	2.5 deg. C.	93 lbs.	5 lbs.
End 96 hrs.	+8.5 deg. C.	2.5 deg. C.	98 lbs.	5 lbs.

When the odor of chlorine is noticed the source should immediately be located. Never hunt a leak through the sense of smell. Always have a gas mask handy and be sure you have fresh canisters. The mask is not apt to be used, but it gives confidence to the one hunting the leak. Have a bottle of aqua ammonia and a piece of waste fastened to the end of a short stick. Dip the

Paper read before National Safety Council Congress.
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waste into the ammonia and start your search. The moment you come to chlorine in the air, a white fume of ammonium chloride will appear. As you reach a denser volume of chlorine, the white fumes are denser. Thus the leak is quickly located. If this leak is in the piping, etc., shut off the valves at the containers and repair. If in a valve on the container or the container itself, and it cannot be stopped, connect the gas valve from the container to your absorption system and begin to operate. The liquid cannot evaporate in the containers, without the application of heat, as fast as the gas is absorbed in your system, and thus the leak quickly stops.

As to the properties of chlorine, it is non-inflammable, and not poisonous, in the sense that carbon monoxide or phosgene for instance is poisonous. We can therefore eliminate Nos. 1 and 2, and confine ourselves to No. 3.

The immediate result of inhaling a large quantity of chlorine gas is the inflammation of the tissues lining the throat with resulting coughing and nausea. While it is highly irritating and extremely uncomfortable, it is never fatal—unless the subject remains for a considerable period in an atmosphere of highly concentrated gas.

Should a person be affected by chlorine gas we recommend the following treatment: Remove at once to the open air and away from all gas fumes. Place the patient flat on his back with head slightly elevated, and give a half teaspoonful of essence of peppermint, or a moderate dose of bromo seltzer or whiskey. This will relieve the tendency to cough and soothe the inflamed membranes, allowing the passage of air and promoting the action of the respiratory organs. The person affected should himself resist as much as possible the impulse to cough. A mustard plaster on the chest will give prompt relief. While there are never any serious after-effects, a physician should always be called.

As this discussion is before the Pulp and Paper Section, we can safely assume that we are preparing to store a considerable quantity of chlorine. First let us discuss storage in either cylinders or ton drums.

The storage space should be selected with an eye to easy unloading and transfer to the aborption room. Either of the smaller cylinders may be readily unloaded from a car and rolled over a floor by one man, but if possible, overhead trolleys should be installed for carrying them. They are suspended from the trolley by a chain block and grasped by a pair of tongs made especially for this purpose. Cylinders are usually handled and stored in an upright position. Ton drums are shipped in gondola cars, each drum resting in a cradle. In unloading them it is therefore necessary to lift the drum clear of the car by means of a chain block and crane or similar device, after which it may be conveyed to the absorption room by either rolling over a level floor or track; or carried by an overhead trolley or industrial car. Ton drums are always used and stored in a horizontal position. The storage had best be under a roof but without sides on a concrete floor above any possible flood line. It would hardly seem necessary to enclose the storage space to protect against unauthorized handling of the cylinders.

The large user will wish to receive this material in the 30,000-lb. container, which is permanently fastened to a standard freight car and thus becomes a tank car, and so freight is paid only on the contents. This means a very large saving in the delivered cost of the bleaching material. Thus far the major portion of the material moved in tank cars has been delivered from the car directly into the absorption system, the cars in many cases being emptied in from four to six days. Here again is a marked reduction in cost due to elimination of handling charges.

Mills using liquid chlorine, who can take tank car deliveries, should face the storage problem. There are two methods open. First, the filling of the 2,000-lb. container or the so-called ton drum, or fixed tanks large enough to take one tank car only. Both methods are now being installed for the purpose of getting comparative data.

In our opinion, the local conditions affect this problem so that a detailed discussion of the best method of storage is useless—at least at the present state of the art. The problem is, however, one which can readily be worked out for any particular case.

Highway Work In Minnesota

The state highway commissioner of Minnesota, Charles M. Babcock, has recently issued a statement concerning the possibility of giving employment to labor on the highways during the winter. He estimated that more than 10,000 men and hundreds of teams could earn upwards of $7,500,000 in wages on Minnesota highways this winter. He finds that labor this year has been receiving more than 65 per cent of the amount paid to contractors and that winter work will give labor a still higher percentage because of the relatively larger amount of graveling and distribution of materials that would be done. About 10,150 men were employed this season on the trunk routes, of which 6,300 were still at work at the end of September, but practically all of them would lose their jobs about November 1 unless arrangement is made for continuing the work throughout the winter.

During this season there has been spent on the trunk highways $4,758,026 for grading, $1,605,122 for gravel surfacing and about $6,500,000 for other work.

Six hundred and eighty miles of grading this year bring the total miles of trunk routes graded to 2,179; 215 miles have been paved, 103 of them during the present season and 428 miles of graveling this season bring the total gravel surface to 1,809. In addition, the maintenance department this season regraveled 462 miles and reshaped 713 miles. The program for the season is more than two-thirds finished.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Building Bridge Piers on Rock in Shallow Water

Short span bridges often need to have their concrete abutments or intermediate piers carried down to footings on rock bottom in shallow water or under a few feet of earth close to the river, where the ground is saturated and water flows freely below the river level.

In such cases the contractor is sometimes unduly discouraged because he is not familiar with work below water level and ordinary excavation and sheeting will not keep the site of the pier dry. If the bottom is very irregular or the current swift, the work may prove difficult and expensive, but under ordinary conditions of still water not more than 3 or 4 feet deep and having a smooth regular bottom, the footings can generally be put in satisfactorily without excessive costs or delay.

EARTH COFFERDAMS

If the contractor has work on the same job or near by involving drainage or other excavation that produces waste spoil, almost any kind of material excepting large stones and boulders can be used to form the cofferdam enclosing the footings.

In rare cases where local conditions and topography are favorable it may be possible to make a cut off, or by-pass the water around the site by building dams across the channel above and below the bridge location and turning the flow of the stream through a new channel cut for this purpose or through a pipe or flume discharging into the old bed below the lower dam.

If there is a falls or rapids in the river just below the bridge site it may obviate the necessity for the lower dam and might even provide sufficient head to make it possible to syphon a very small flow through a pipe laid on the surface of the ground and thus greatly reduce the cost of the by-pass if the pipe, which may be of very light construction, is conveniently available from stock or from local sources or can be temporarily borrowed from permanent construction.

Operations should be arranged if possible to be carried on at the time of minimum stream flow when the bed of the river may be naturally almost dry and the trickle of water that would then accumulate considerable volume if backed up by the dam, may be carried in an ordinary water pipe.

Almost any earth, rock or gravel may be used to give stability to the cofferdam, but unless it contains a suitable amount of fine compactible material it will not be watertight, but it may be placed on the upstream side with a comparatively thin layer of small stones and gravel, filling the interstices of coarser stone and covered in turn with mixed sand and fine gravel, sand, earth or preferably clay, which will generally make the dam reasonably tight.

If there are leaks under the dam or through the fissues in the rock bottom that produce a considerable flow into the enclosed space, it may be possible to excavate a rough channel to carry it to a sump, where a steam or gasoline pump can be installed that will handle a considerable volume of water cheaply.

STOP LEAKS AND PUMPING

Careful examination may disclose the location of the most important leaks, and sand, clay and even hay, straw or manure may be forced into them and sometimes be successful in closing them. It may also be possible to cover the particularly bad portions of the bottom with canvas held down by a mass of earth or clay dumped over it.

For very shallow water with a smooth, flat bottom a dam can often be made with empty cement bags, three-fourths filled with sand and piled up carefully to form an enclosing wall. This will stop the free flow of the water and will conform closely to the surface of the bottom and when reinforced by clay on the outer face may make a sufficiently tight dam, easily built and shifted, that does not occupy so much space or require so much material as a dam of loose earth.

If the current is swift enough to scour away an earth dam, boxes or cribs of convenient size made of any available timber, or boards, no matter how poor, that will hold together can be arranged close together enclosing the pier, ballasted with stone, sunk to position and filled with earth and clay and more earth and clay if necessary dumped around the outside.

If serious leaks occur all over the enclosed area, the latter may be subdivided into one or more smaller areas by successive dams or partitions built across the main cofferdam, leaving small portions of space in which the leakage is much diminished and may be pumped out, one at a time, and the footing placed in them, sealing the leaking bottom and providing a base to which

the watertight forms can be attached successively, eventually extending over the full area of the completed foundation.

ENCLOSING AND VENTING LEAKS

If large definite leaks are discovered inside the cofferdam and cannot be stopped, a dam can sometimes be built around them, enclosing them and enabling the rest of the area to be unwatered and the footing laid, enclosing the leaks in the well, which can, if necessary, be eventually closed under pressure. For small leaks vertical steel vent pipes may be inserted in the hole in the bottom of the river, preventing the accumulation of water pressure and being held in position by concrete deposited around and protecting them until it has set and has sufficient strength and weight to resist the upward pressure. The footing may then be completed with the vent pipe passing through it and eventually the latter can be filled or closed under pressure and cut off flush with the top of the concrete, thus remaining permanently in position without injury to the structure.

SUBMERGED FORMS

The forms for the piers may be made with watertight panels of heavy boards bolted together through outside vertical corner posts. The lower edges of the vertical walls may be cut to conform as closely as possible with the rock surface. The complete form, a little higher than the depth of the water, should be built on land, assembled complete, floated or derricked to position, centered and sunk with ballast and the bottom sealed or partly sealed with clay dumped around the outside or with a canvas apron attached to the lower edge, extending over the surface of the rock and covered with clay or earth.

CONCRETING UNDER WATER

If this does not permit the water to be entirely pumped out, it will probably enable it to be brought down considerably below the level of the water outside, reducing the depth so much that the men can work in it to clean and dress the rock surface if necessary, and to place concrete.

It must be remembered that good concrete properly handled may be placed in the water without injury so that a few inches of water in the bottom of the form is not a serious matter if the work is promptly and correctly handled.

Concrete should never be deposited loose in flowing water, but may be carefully dumped in shallow still water. It is better, however, to deposit it carefully with a bottom dumping bucket or through a trough or tube resting on the bottom that protects it from the water until it is in position. Concrete in heavy paper or burlap bags may be lowered to the bottom of shallow slowly running water and the bags opened by hand after they have reached the bottom and they are then withdrawn, leaving the concrete deposited in position.

SEALING THE BOTTOM

If the piers are large and the bottom is satisfactory in its natural condition or can be made so by scraping, dragging, etc., under water, the pier may be built with a permanent or detachable form carefully secured in position without any attempt at first to remove the water from the interior.

The form, which can be built on the shore, should be made watertight with gaskets, packing or caulking, and after it is in position concrete, to a depth of a foot or more, should be deposited under water covering the entire bottom, and when it is set forming a shield to exclude the water from the leaks under the edges and through the rock bottom. The depth of this concrete must be calculated great enough so that the mass of concrete will be heavy enough to resist the upward pressure at the bottom, else it may be floated up and broken when the form or cofferdam is pumped out above it. A thickness of concrete a little more than one-third of the distance from the top to the waterlevel outside will suffice for this purpose, and after it has set the form may be pumped out and the remainder of the concrete placed in the dry provided the form has been made strong enough and is sufficiently well braced by the interior pieces to resist the outer pressure, which will be heavy in proportion to the depth of the water.

TREMIE CONCRETING

If satisfactory provision is made for depositing the concrete under water it will be unnecessary to make a form watertight or brace it heavily, and all of the submerged concrete may be placed by means of a bottom-dump bucket or a Tremie. This consists of a moveable steel or wooden tube not less than six inches in diameter, terminating at the top in a hopper. Provision must be made for steadily moving it longitudinally and transversely so as cover the entire area, and to raise and lower it by a tackle, derrick, or some other convenient method.

The bottom should be temporarily enclosed by an easily removable board or some other device, the tube filled with concrete and lowered until it rests on the bottom. When all is in readiness the bottom of the tube should be opened and the tube raised a few inches allowing the concrete to flow out of the bottom, where it will soon form a heap, sealing the tube so that the flow will cease if the tube remains stationary. Provision must be made to supply fresh concrete to the hopper continually and the tube should be slowly moved back and forth across the form and from end to end, great care being taken to always have it filled and the hopper half filled with concrete to insure a steady continuous flow that prevents water from entering the tube and washing the concrete away. If this is carefully done, the concrete deposited under water should be as good as that laid in the open air. The work of the tremie must be carried on continuously day and night until the full mass of concrete is carried up above water level. If at any time it ceases, the tremie should be imme-

diately withdrawn and the bottom closed, concrete filled in and the original operations resumed, otherwise there is likely to be a poor batch of concrete deposited when the first part of it is dumped into the tube full of water. For tremie work the concrete should be thoroughly mixed and should be rich and as dry as possible. If submerged concrete is allowed to stand a few hours the top will become covered with "laitance," a thick slimy substance that must be scraped or washed away before more concrete is deposited, else it will make a bad weak place and prevent the set and bonding of the concrete placed against it.

Per Capita Use of Electricity, Gas and Water

General averages of such use classified by size of city and geographical location, with maximums to be provided for in capacity of plant.

We desire to obtain statistics upon the K. W. hrs., the gallons of water, the gallons of sewage, the cubic feet of illuminating gas, used by 1000 inhabitants and to obtain data regarding the load characteristics. I am asking if you know of any municipalities, engineering schools, associations or publications that have considered these problems. Any reference or data that you can send us will be greatly appreciated.

In answering the above question, we called attention to the abundance of figures available in reports of cities, commissions and committees of technical societies, which we endeavored to summarize as follows:

ELECTRIC CONSUMPTION

Taking up first the matter of electricity, the total amount consumed per capita per year for light, grouping all of the cities of the country in accordance with their population, varied from 44 k. w. h. for communities of under 1,000 to 105 k. w. h. for communities of 500,000 and over. In a general way the per capita use of electricity increases with the size of the community. Current used for power varied from an average of 95 k. w. h. for communities of between 2,000 and 5,000 to 269 for communities of between 50,000 and 100,000; the amount of power consumed not varying directly as the population, and averaging 200 k. w. h. per capita for the entire country. The above figures are those given by the Bureau of the Census and applied to the year 1917, the latest yet given out by the Census Bureau.

Analyzing the same figures by states instead of by population groups, we find the consumption for light varying from 37 per capita in Virginia to a maximum of 152 in California; the average for the entire country being 81. The consumption for power varied from a minimum of 24 in Arkansas to a maximum of 3,522 per capita in Montana.

It is seen from the above that the amount of current consumed varies largely with the size and geographical location of the community in question. Two hundred and fifty-four stations in Minnesota in 1917 showed an average per capita consumption of 102 k. w. h. for light and 181 for power. In each case the figures given are based upon the population actually served with electric current and not upon the total population of the state.

As to the capacity of the plant, we find that the kilowatt capacity of the dynamos operated averages about one kilowatt for each 2,500 k. w. h. sold during the year. This varies quite widely, however, from 2,000 or a little under to more than 5,000, the ratio in Montana being about 5,300 k. w. h. per kilowatt capacity, this being the average of 60 stations. The excess capacity is, of course, to provide for peak loads, stand-by apparatus and increase in business.

Probably the most detailed information to be found concerning both electricity and gas consumed and manufactured is that collected by the Board of Gas and Electric Light Commissioners of Massachusetts and published annually. From their report for the year 1919, the latest yet available, we quote a few figures, one concerning the largest plant, the Edison in Boston and the other concerning one of the smallest, that at Charlemont. The Edison company had 96,885 customers using incandescent lights only, 272 using both arc and incandescent, 1,239 using power only and 13,163 using both light and power, a total of 111,569. The total lighting load was 152,007 kw. and the total power load was 226,325, a total of 379,332. In Charlemont there were 41 customers, the total lighting load was 30.5 kw. and there was no power load. The variations between these two is considerable, the total load being about 3.4 kw. per customer in the Edison Boston plant and about 0.74 kw. in Charlemont. The maximum station load in the large plant was 95,774, falling to 25,000 on the day of least output. No records of this kind are available for the Charlemont plant. In general, however, the maximum varies from 1-½ to 3 times that of the day of least output.

GAS CONSUMPTION

Taking up next the matter of gas, we find that in all the Massachusetts cities averaged together the consumption of gas during the year averaged 20,335 feet per consumer, varying from a minimum of 5,820 in Oak Bluffs with a population of 1,245 to a maximum of 36,474 in Newton with a population of 43,114 although Boston was not far behind with an average of 32,325. In the small town of Oak Bluffs the amount of gas sold by meter during the year was 1,164,000 while none was sold for public lamps. In Boston the amount sold by meter was 5,794,772,301, while 123,203,871 was sold for lamps. In Boston 3.37% was unaccounted for, while in Oak Bluffs 25.57% of the gas was unaccounted for. The daily capacity of the works in Boston was 42,300,000 feet and the greatest daily output was 22,639,000 and the least output 10,602,000. In Oak Bluffs the capacity of

the works was 150,000, the greatest output was 28,000 and the least output 11,000.

WATER CONSUMPTION

In the matter of water the figures vary nearly as widely, running from a minimum of about 30 gallons per capita to a maximum of more than 200. With leakage from mains and waste by consumers reduced to a minimum, and estimating the consumption on the number of consumers rather than on the total population, the great majority of places will not require more than from 40 to 70 gallons per capita; except that where there is a relatively large amount of water used by manufacturing and other industries, the consumption may be increased by as much as 100 gallons per capita for these purposes alone.

The consumption of water varies somewhat with the seasons, but not quite so much as that of electricity and gas when used for lighting. The maximum daily consumption of water will ordinarily run about 50 per cent above the yearly average, although it may reach 100 per cent. The hourly maximum will probably reach 200 and possibly 250 per cent of the average for the year. The distribution system, of course, should provide for the maximum hourly rate, but the pumping station, if there is one, need not provide for this if there are reservoirs of sufficient capacity. The plant, however, should, as in the case of an electric light plant, have reserve units to be put into service in case of a breakdown and should have ample provision for growth in consumption for several years in the future.

AMOUNT OF SEWAGE

The amount of sewage from buildings is ordinarily assumed to be the same as the amount of water entering the same buildings. However, some water used for sprinkling lawns, etc., does not reach the sewers, and on the other hand some manufacturing plants having their own water supply may discharge this into the sewer. The amount of each of these must be judged from local conditions.

These various subjects will be found discussed at length in text books dealing with these matters, in papers before the different electric, water works and engineering societies, in technical papers, in reports of municipal plants, etc.

National Contractors Drive for Construction

Meetings of representative citizens and general contractors have been arranged in the principal cities of the country to discuss ways and means of getting public construction under way. W. O. Winston of Minneapolis, president of the Associated General Contractors of America, W. A. Rogers of Chicago, F. L. Cranford and D. A. Garber of New York, together with G. W. Buchholz, secretary, and E. J. Harding, assistant secretary of the Associated General Contractors of America, will address the meetings in behalf of an aggresive program, both national and local, to start construction.

That this construction program cannot be gotten under way without the organized effort of community and construction interests, will be the message carried by these leaders. While the construction of homes, schools, buildings, highways, streets, railroads, public works and repairs of all kinds, reclamation projects and hydro-electric development, as urged by the National Conference on Unemployment, will undoubtedly directly set to work a million men who will in turn give work to millions more, there is needed first a thorough-going analysis of present construction costs in every city, including costs of finance, insurance and bonds, materials, labor, transportation and management. Moreover, there must be adequate provision for settling questions in dispute without the great loss of time caused by strikes and lockouts; and there must be sincere co-operation between organizations representing every element of the construction industry.

To start this work, central committees of general contractors in each of the cities will be appointed as nuclei of a permanent organization. The work now being done by similar organizations affiliated with the Associated General Contractors of America in other cities will be outlined, as illustrative of what might be accomplished. Under the direction of General R. C. Marshall, Jr., formerly chief of the construction division of the War Department and chairman of the construction committee of the President's Unemployment Conference, this work has already been organized in from twenty-five to thirty cities, covering in some instances entire states. From headquarters in Washington, General Marshall, as general manager of the Associated General Contractors of America, is already working through national committees of general contractors on labor, materials, methods, contracts, insurance and bonds, transportation, codes, legislation, information and statistics to bring about conditions which will make possible the carrying out of the construction program outlined by the President's Conference.

The organization of local conference boards representing architects, engineers, contractors and labor to handle local jurisdictional disputes and other local construction problems will be recommended. Local committees will be urged to secure the fall letting of public work and highway contracts. Other committees to secure adequate legislation for highway and water-power development will be recommended. Investigations in better methods of accounting and estimating and improved contract forms will be suggested. Close co-operation with national headquarters in the entire campaign will be assured through monthly, weekly and special bulletins and reports.

Recent Legal Decisions

ACQUISITION OF WATER SYSTEM BY MUNICIPALITY—TIME OF VALUATION

The California Railroad Commission, in fixing the amount of just compensation to be paid by the city of Auburn for the water system, owned by Pacific Gas & Electric Company, supplying consumers in the city, holds that a valuation of the property made for condemnation purposes should be made as of the date of the filing of the original application therefor with the commission.

RATES FOR PRIVATE FIRE PROTECTION SERVICE

The Indiana Public Service Commission has frequently held that a flat rate equal to the monthly minimum charge for service connections of the same size is a reasonable rate for private fire protection service. The chief element of cost in furnishing private fire protection service is not the amount of water which flows through the connection, but the readiness to provide necessary fire pressure when required. The demand which this fire pressure will make upon the plant of the water company varies with the diameter of the required service connection.

RATES FOR PUBLIC FIRE PROTECTION SERVICE

The Maine Public Utilities Commission has several times held that the price per hydrant for fire service is not the true measure of the value of the entire service, but that the gross revenue needed and the area and value of the property protected are necessarily to be carefully considered. The amount which must ordinarily be paid for public fire protection is about 32 per cent of the gross revenue needed.

WATER COMPANY CANNOT SHUT OFF HYDRANT SERVICE FOR NONPAYMENT

The Missouri Public Service Commission holds, in proceedings by Webb City and City of Carterville to compel the Missouri Public Utilities Company to furnish fire hydrant service that, although the cities may owe the company large sums of money, the company has not the right to cut off fire hydrant service as it would the ordinary service of a private consumer, for nonpayment of bills, the cities being governmental corporations, and limited in their powers to raise money by constitutional provisions. On the other hand, when the amount of indebtedness incurred by each of them is finally determined, they cannot escape payment.

BOARD OF EDUCATION NOT COMPETENT SIGNER OF PAVING PETITION

The Kansas Supreme Court holds, Dunsworth v. City of Hutchinson, 199 Pac. 89, that, under a statute requiring a petition for the paving of a street to be signed by the resident owners of one-half the property fronting on it, the board of education, whose jurisdiction covers the city and certain attached territory, is not made a competent signer by virtue of one of its school sites abutting thereon.

CONTRACTS OF MANAGER OF MUNICIPAL LIGHTING PLANT UNDER MASSACHUSETTS STATUTE

The Circuit Court of Appeals, First Circuit, holds, Rockhill Iron & Coal Co. v. City of Taunton, 273 Fed. 96, reversing 261 Fed. 234, that under Acts of Massachusetts, 1905, c. 410, par. 3, authorizing the mayor of a city to appoint a manager of municipal lighting, who shall, under the direction and control of the mayor, have full charge of the operation and management of the plant, and of the purchase of supplies, a manager appointed for a fixed term can, in the absence of any regulations by the mayor to the contrary, make a contract for the purchase of coal required for the plant for a period extending beyond the term of the manager's appointment, which is binding upon the city after the expiration of such term.

CONTRACT FOR PURCHASE OF FIRE APPARATUS—LUMP BID INVALID WHERE SEPARATE BIDS CALLED FOR

The New Jersey Supreme Court holds, Pew v. Commissioners of Fire Dist. No. 1, 114, Atl. 151. that an award by a public body of a contract for the doing of work or the purchase of supplies, made after advertisement and competitive bidding, must be according to the terms advertised to prospective bidders, so that all may be on the same footing. An advertisement for competitive bids to furnish a fire engine called for a truck with a pumping system and body to carry 1,250 feet of hose, "each part proposed to be furnished to be separately specified by the bidder and separately priced." Applying the above rule, it is held that the contract could not be awarded on a lump bid for the entire apparatus.

VALIDITY OF A SEWER TAX BILL

In a suit to cancel and set aside a tax bill for the construction of a sewer in the city of St. Louis, the Missouri Supreme Court, St. Louis Malleable Co. v. George G. Prendergast Const. Co., 231 S. W. 989, decided the following points: The tax bill was prima facie evidence of its validity. No notice to property owners of the establishment of a taxing sewer district is necessary, as decided by the Missouri Supreme Court and the Supreme Court of the United States (Embree v. Kansas City Road Dist., 240 U. S. 242). The Missouri court has repeatedly held that the action of the municipal authorities in the establishment of a sewer district is conclusive in the absence of fraud, and not subject to review by the courts. No evidence of fraud was shown, much less any evidence connecting the contractor with fraud. A complaint of fraud comes too late after the work is completed. The municipal authorities of the city of St. Louis are the sole judges of the dimensions of contemplated sewers. Silent acquiescence with knowledge of the improvement, especially when accompanied by acceptance of its benefits, estops the property owner from denying validity of the tax bill.

NEWS OF THE SOCIETIES

Oct. 24-28 — AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, St. Petersburg, Fla.

Oct. 25—ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Get-together dinner. Secretary, J. T. Wikle, Fulton Bag & Cotton Mills, Atlanta.

Oct. 25—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers' Club. Secretary, W. H. Kavanaugh, University of Pennsylvania, Philadelphia.

Oct. 25—PROVIDENCE, R. I., ENGINEERING SOCIETY, MUNICIPAL SECTION.

Oct. 26-27—OKLAHOMA SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting. Oklahoma City.

Oct. 28—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Newark, N. J.

Oct. 28-29—TEXAS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Dallas, Tex. Sec., E. N. Noyes, Dallas County Bank bldg., Dallas.

Oct. 28-29 — INDIANAPOLIS SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, George R. Popp, Jr., Indianapolis Water Co.

Oct. 31—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Get-together fall meeting. New York City.

Oct. 31-Nov. 5 — NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 1 — CLEVELAND SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Hotel Winton. Secretary, Charles H. Day, Illuminating Co.

Nov. 1—VIRGINIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Fall rally meeting. Secretary, Charles Loeber, R. M. Anderson Co., Richmond.

Nov. 1-4—INDUSTRIAL RELATIONS ASSOCIATIONS OF AMERICA, Waldorf-Astoria Hotel, New York City.

Nov. 2—BUFFALO SECTION AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Lafayette Hotel. Secretary, F. B. Hubbard, 146 Arkansas st.

Nov. 2—CENTRAL PENNSYLVANIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Williamsport, Pa. Secretary, Prof. P. P. Henshall, Penn. State College.

Nov. 3 — HARTFORD BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Bond Hotel. Secretary, W. D. Halsey, Hartford Steam Boiler Inspection and Insurance Co.

Nov. 4 — MINNESOTA SECTION, AMERICAN WATER WORKS ASSOCIATION. Minneapolis, Minn.. Secretary, H. A. Whittaker.

Nov. 8 — WATERBURY BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce Hall. Secretary, J. R. Putnam, 64 Woodside ave.

Nov. 9—BALTIMORE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers' Club. Secretary, Prof. A. G. Christie, Johns Hopkins University.

Nov. 13-17—AMERICAN CIVIC ASSOCIATION. Chicago, Ill. Headquarters, 905-7 Union Trust bldg., Washington, D. C.

Nov. 14—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with A. I. E. E., A. I. M. E. and A. S. C. E.

Nov. 14—NEW HAVEN BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Mason Laboratory, Yale University. Secretary, Prof. S. W. Dudley, 400 Temple st., New Haven.

Nov. 14 — NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies bldg., New York City. Sec., G. I. Rhodes, 115 Broadway, New York City.

Nov. 14-16—CITY MANAGERS' ASSOCIATION. Annual meeting. Chicago. Secretary, H. G. Otis, city mgr., Clarksburg, W. Va.

Nov. 14-18 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

Nov. 15-18—ATLANTIC DEEP WATERWAYS ASSOCIATION. Savannah, Ga. Headquarters, Real Estate Trust bldg., Philadelphia, Pa.

Nov. 16-18 — NATIONAL MUNICIPAL LEAGUE. Chicago. Secretary, H. W. Dodd, 261 Broadway, New York City.

Nov. 17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Joint meeting with Society of Naval Architects and Marine Engineers. New York.

Nov. 17-18—SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS. New York.

Nov. 17 — BRIDGEPORT BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce.

Nov. 17—TOLEDO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Toledo Commerce Club. Secretary, Loring Freed, Atlas Chemical Co.

Nov. 17 — WORCESTER SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Worcester section, A. I. E. E. Secretary, Harry M. Latham, Crompton & Knowles Loom Works.

Nov. 21—CHICAGO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Western Engineering Society.

Nov. 22 — ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Nov. 22—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Adelphia Hotel.

Nov. 25 — COLORADO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Metropole Hotel, Denver. Secretary, William Lester, Vulcan Iron Works.

Nov. 28-29—KANSAS CITY SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Two-day regional meeting. Secretary, Louis Bendit, 517 Finance bldg.

Dec. 1-3—MONTANA IRRIGATION AND DRAINAGE INSTITUTE. Great Falls, Mont.

Dec. 6-9—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 14th annual meeting. Baltimore, Md.

Dec. 22-23—KANSAS ENGINEERING SOCIETY. Hutchinson, Kan.

Jan. 17-20 — AMERICAN ROAD BUILDERS' ASSOCIATION. Annual Convention and good roads show. Chicago, Ill.

May 15-19 — AMERICAN WATER WORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

FEDERATED AMERICAN ENGINEERING SOCIETIES

The executive board of the American Engineering Council, at its meeting in Washington on September 30th, accepted the applications of the Vermont Engineers' Society and the Associated Engineers of Spokane for membership in the Federated American Engineering Societies.

MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK

The Municipal Engineers of the City of New York held its monthly meeting on September 28th. Thomas H. Wiggin who has recently returned from China after two years spent in charge of engineering investigations for the improvement of the Grand Canal of China and the control of the floods of the Yellow River, addressed the society on the subject, "An Engineer's Two years in China."

AMERICAN ASSOCIATION OF PORT AUTHORITIES

The first international and tenth annual convention of the American Association of Port Autohrities opened at Seattle, Ot. 11, with the registration of 120 delegates and guests.

The convention was called to order by President Benjamin Thompson, director of the Port of Tampa, Tampa, Fla. The invocation was given by W. S. Lincoln, commissioner of the Port of Seattle.

Mayor Hugh Caldwell of Seattle delivered an address of welcome, which was responded to by President Thompson, who presented a report of the year's business of the association including his appointment of committees for investigation and reports to be made on the valuation of port properties of the Americas, dredging of waterways and harbor improvements, and insurance of terminal properties. He also reported that a European tour had been completed by a secretary of the association with the result that port authorities in many European countries had become very much interested in the work of the association.

Paper No. 13—J. Spencer Smith, vice-chairman of the Port of New York and president of the New Jersey Board of Commerce and Navigation, on "Port of New York Authority."

Paper No. 14—Capt. F. T. Chambers, Washington, on "United States Government Co-operation in Port Development."

Paper No. 15—Lt. Col. H. C. Boyden, Portland Cement Assn., on "The Practical Side of Scientific Concrete."

The following officers were elected:

President—Benjamin Thompson, director of the Port of Tampa, Tampa, Fla.

Secretary—M. P. Fennell, Jr., secretary harbor commissioners, Montreal, Can.

Treasurer—Victor Gelineau, director Board of Commerce and Navigation, State of New York-New Jersey, Jersey City, N. J.

Vice-presidents—1st, W. O. Hudson, president Board of Port Commissioners, New Orleans, a.; 2nd, J. Spencer Smith, vice-chairman New York-New Jersey Port & Harbor Development Co., Jersey City, N. J.; 3rd, Maj. Gen. Sir David Watson, president Quebec Harbor Commissioners; 4th, John H. McCallum, president Board of State Harbor Commissioners, San Francisco, Cal.; 5th, Chas. R. Francis, chairman Harbor Commission, Port of Chicago, Chicago, Ill.

Directors—William G. Ross, president Harbor Commissioners, Montreal, Can.; Maj. Gen. Lansing H. Beah, chief of engineers, U. S. A., Washington, D. C.; John N. Cole, commissioner, Dept. of Public Works, Boston, Mass.; G. B. Hegardt, engineer and secretary Commission of Public Docks, Portland, Oregon; Dr. W. T. Christensen, president Port of Seattle Commission, Seattle; E. L. Cousins, chief engineer and manager Toronto Harbor Commissioners, Toronto, Canada; Geo. F. Sproule, director Dept. of Wharves, Docks and Ferries, Philadelphia, Pa.

AMERICAN ENGINEERING COUNCIL

Much important business was transacted by the Executive Board of the Council at its Washington meeting. The presiding officers were Calvert W. Townley and J. Parke Channing of New York, vice-presidents. Progress was reported in the direction of establishing a Department of Public Works and confidence was expressed that the recommendations of organized engineering would be recognized in the final plan of government reorganization.

The Council adopted the report of the Committee on Patents, headed by Edwin J. Prindle of New York, urging the passage of the Lampert Bill to remedy conditions in the Patent Office, which, the committee asserted, were menacing the nation's industrial and agricultural welfare.

The Executive Board engaged in a long discussion of the report of the special Committee on Employment, finally appointing a committee of the board to draft resolutions which would crystallize the general thought brought out by the discussion.

In view of the business depression, it was decided not to hold an engineering assembly next January. The committee in charge of the arrangements was converted into a program and entertainment committee for the annual meeting of the Council to be held in Washington in January.

The application for membership of the Vermont Engineers Society and the Associated Engineers of Spokane were approved.

The board passed a resolution approving the decision of the National Board for Jurisdictional Awards in the Building Industry with respect to the award affecting the Brotherhood of Carpenters. The resolution expressed confidence in Rudolph P. Miller, American Engineering Council representative.

ALBANY ENGINEERS

The Albany Society of Civil Engineers and the Albany chapter, A. A. E. held a joint meeting on October 4th, which was addressed by Herbert S. Sisson, state highway commissioner, on "The Progress and Development of the Highway System of New York State."

HARVARD ENGINEERING SOCIETY

The Harvard Engineering Society held a joint meeting with the Harvard Club in New York on October 14th at New York City. At this meeting it was addressed by Clifford M. Holland, chief engineer of the New York and New Jersey tunnel commissions on "The Vehicular Tunnel," and by George A. Post, president of the Hudson River Bridge Corporation, on "The Proposed Suspension Bridge."

OFFICERS OF THE NATIONAL DRAINAGE CONGRESS

Clark E. Jacoby, engineer, Kansas City, was elected president of the National Drainage Congress at the tenth annual convention at St. Paul on September 22-24th; Jacob A. Harmon, Peoria, Ill., first vice-president; Dr. F. H. Newell, Washington, D. C., second vice-president; A. J. Bracken, Chicago and Memphis, third vice-president; William Kemper, Kansas City, treasurer; and J. H. Pratt, North Carolina; A. L. Maxwell and L. K. Sherman, Illinois; E. R. Jones, Wisconsin; Leroy Percy, Mississippi, and W. R. Compton, New York, directors. Kansas City was chosen as the 1922 meeting place.

CALIFORNIA SECTION, AMERICAN WATER WORKS ASSOCIATION

The annual convention of the California section, A. W. W. A., was held in Los Angeles on October 1st and 2nd. A number of papers and discussions featured the first day's session. The annual dinner was given that evening, when William Mulholland, chief engineer of the Los Angeles water department, talked on "The Los Angeles Water Supply and Distribution." On Sunday trips were made to points of interest on the Los Angeles water system.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The first meeting for the administrative year, 1921-1922, was held on October 19, 1921, at 8.00 P. M., Auditorium, Engineering Societies Bldg., 33 West 39th St., New York.

It was a joint meeting of the Metropolitan Sections of the four national societies, the A. S. C. E., the A. S. M. E., the A. I. M. E. and the A. I. E. E. Mr. Farley Osgood, chairman of the New York Section of the Institute, will preside. The subject for the evening was Financing of Large Engineering Undertakings.

The speakers announced were Arthur B. Leach of A. B. Leach & Co., bankers, New York, and Philip Cabot of White, Weld & Co., Boston. Other men of prominence in this field had been invited to present their views. Among those taking part in the discussion were John H. Delaney, former Transit Construction Commissioner, New York, followed by J. H. Williams of Day & Zimmerman, and others.

MONTREAL TOWN PLANNING CONFERENCE

The first town planning conference on Montreal was held on Sept. 29th-Oct. 1, and was well attended by town planners, architects, government officials, engineers and civic employees, also by numerous visitors. The Thursday session was held in French and the Friday session in English, while on Saturday the delegates devoted the day to trips of inspection to various places of interest from a town planning standpoint. Several interesting papers were read on street planning, automobiles and conduits, congestion in cities, geology of Montreal, and rapid transit. There were also about 100 exhibits, mostly of maps and photographs of town planning schemes; and an exhibit by the Air Board of photographs taken from aeroplanes, showing the great possibilities of usefulness in aerial survey work.

LOUISIANA ENGINEERING SOCIETY

At a regular meeting of the Louisiana Engineering Society, held October 10th, an address by H. G. Martin, on "The Delgado Trade School," was illustrated with lantern slides.

PERSONALS

Hastings, Dr. C. J., medical health officer for the city of Toronto, has been appointed head of the new Public Welfare Department of that city. He will continue as head of the health department, of which the Welfare Department will really be a branch.

Warner, Raymond A., formerly with the city engineer of Detroit, Mich., has been appointed assistant city engineer to H. R. O'Mara at Mt. Clements, Mich.

Conlin, C. J., formerly road engineer of Cuyahoga county, has been appointed construction engineer for the North Carolina state highway commission, District 4, at Durham.

Jones, R. L., has been appoined office engineer, division of engineering and irrigation, state department of public works.

Hays, D. W., has been appointed supervising engineer of the United Irrigation District, Alberta, Canada.

Muenster, Roland A., has been appointed assistant county road engineer of Bell county, Texas.

Watters, George E., has been appointed engineer of the Board of Water and Sewer Commissioners, New London, Conn., to succeed Walter H. Richards, who retired after fifty years of service.

Joyner, F. H., has been appointed assistant highways engineer for Los Angeles county, Cal., by the state highway commission, and will have charge of the general inspection for the southern district of that state.

Martin, C. A., has been appointed construction engineer on paving and sewer work for Puyallup, Wash.

Fletcher, George A., former city engineer and waterworks superintendent, died recently in Pitcher, Okla., at the age of 57.

Allan Garratt has opened an office in Boston for consultation and advisory work in hydraulic engineering.

Voorhees, S. S., one of the technologists of the U. S. Bureau of Standards, died in Portland, Me., on September 24th.

Hudgins, F. D., formerly with the bureau of public roads at St. Paul, has accepted the position of state highway engineer for South Dakota, with headquarters at Pierre.

May, Charles A., assistant state highway engineer of New Mexico, has been appointed state engineer.

Kennedy, Leo, has been appointed civil engineer for the Happy Valley Irrigation District, Cal.

Bernier, J. A., has been appointed civil city engineer of Shawinigan Falls, Quebec.

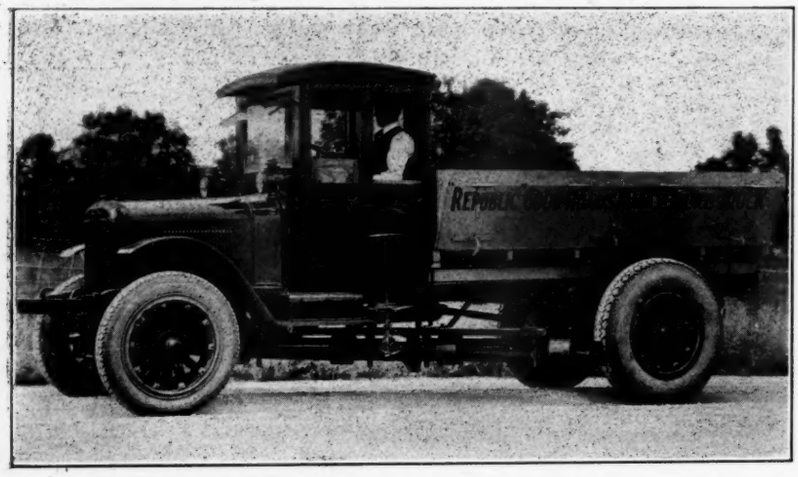
Schuyler, Philip K., formerly in the bridge department of the Wisconsin highway commission, has taken a position with the bridge department of the North Carolina highway commission at Raleigh.

Harcourt, Ralph, mayor of Longport, N. J., has tendered his resignation to the borough commissioners, to take effect immediately after the election of his successor.

Kirk, Robert E., deputy county surveyor of Hennepin county, Minn., died recently at the age of 74.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



ROAD SCRAPING WITH "REPUBLIC" TRUCKS

The Republic Truck Sales Corporation, of Alma, Mich., is now equipping their 2½-ton trucks known as the "Republic Good Roads Maintaining Truck," with a Root spring scraper for use in maintaining gravel and other roads. The scraper attachment has been mounted on other size trucks, but the best satisfaction seems to be obtained from the 2½-ton, as this motor is of sufficient power to give the desired lugging power at slow speed and the truck has sufficient weight to hold the scraper hard against the ground. A speed of between 8 and 12 miles an hour seems to be most satisfactory, at which speed all holes and ruts are evenly filled.

The scraper itself consists of a blade edged with 3-8 inch by 2-inch steel mounted on four steel springs 6 inches wide, which in turn are mounted on a round, hollow bar which is adjustable by means of a chain and ratchet post. The bar is mounted on a 2x6-inch oak timber through adjustable brackets, and this timber is then mounted on the chassis frame with heavy brackets and substantial braces. When not in use the scraper is raised and gives a clearance of 8 inches under the lowest point.

To provide for night work where the traffic is too heavy for day maintenance, special lights are attached and operated by the motor-driven generator and storage battery for effectively lighting each side of the road.

While this unit was primarily built for maintaining gravel roads, a number of commissioners have placed it in immediate service for filling in the ruts worn on roads that have been newly graveled.

The managing engineer of the road commission of Kent county, Mich., O. S. Hess, reported a few weeks ago that he had started last year with two of these scrapers and had put three more in operation this season, all for use for maintaining gravel roads. One of these, he states, will cover about the same mileage of road in a day that would ordinarily be taken care of by 6 team patrols equipped with light graders or floats. They cover long stretches of road in a very short time, as during or immediately after rains, which it is impracticable to do with floats and light scrapers. He is maintaining about 250 miles of gravel roads and still uses a number of team patrols, but is gradually supplanting them by spring scrapers on the heavily traveled lines, decreasing the total maintenance cost and giving better roads continuously. He compares the cost on the basis of a truck scraper covering 80 miles a day and 6 teams covering the same distance. In this comparison the cost of the truck is $2.30 for gasoline at $.23 a gallon, $.50 for oil, $2.94 for deterioration of truck, $3.00 for deterioration of tires and $5.00 for driver, a total of $13.74. The 6 teams at $.60 per hour cost $36.00 and deterioration of the 6 scrapers $3.00, giving a total of $39.00. This gives a saving of $25.,26 or more than $3,000 a year on the basis of 6 months operation with 20 working days a month. He reports that the scrapers also work well in snow when this is not too deep.

INDUSTRIAL NOTES

The Engineering Equipment & Supply Co. has been absorbed by the J. E. Heatton Co., dealers in machine tools, contractors' machinery, etc., and offices are now at 30 Church Street, New York City.

The Standard Steel Works, Kansas City, Mo., has moved into its new plant in North Kansas City, where it will manufacture Standard steel dump bodies, hand hoists, truck tanks, road-workers' equipment and a complete line of mill and elevator equipment.

E. E. Aldous has been appointed St. Paul, Minneapolis and Duluth representative of the American Steel & Wire Co., Chicago.

The Central Steel Co., Massillon, sillon Rolling Mill Co. and the National Pressed Steel Co., and will carry out all the valid contracts and obligations of the other two companies.

The Republic Truck Co., Inc., of Alma, Mich., at its annual meeting on September 29th elected the following board of directors for the coming year: John N. Willys, W. P. Chrysler, J. E. Kepperley, E. C. King, W. J. Baxter and H. I. Shepherd, all of New York City; Frank E. Smith of St. Louis, Mo.; T. A. Burt, Urbana, Ill., and Francis King, Alma, Mich.

The Schaffer Engineering & Equipment Co. has combined its administrative, sales and manufacturing departments in its new general office adjacent to the factory in Pittsburgh, Pa.

The Arthur Sachsse Corp., New York, has been formed by Arthur Sachsse and Felix F. Wiener, to promote the sale of patents, formulas and processes, dealing principally with inventions made during the war in Germany, and offering manufacturers' rights to American firms.

The Yeomans Bros. Co., Chicago, manufacturers of sewage ejectors and drainage pumps, announces the following new representatives: P. E. Fallon, Little Rock, Ark., and Morton McI. Dukehart & Co., Baltimore, Md.

Thomas N. Gilmore has opened an office in New York City as consulting engineer specializing in lay-outs and designs of railroad shops, locomotive terminals, power plants, steam stations and industrial plants and in the improvement of these facilities. Mr. Gilmore has been connected with Westinghouse, Church, Kerr & Co. for the past 16 years, in charge of railroad shop design and construction and later as vice-president and chief engineer in charge of all engineering and construction.

GRANITE FLOOR SLAB TESTS

The Cement Gun Co., Inc., and the Consolidated Expanded Metal Cos., announce that at noon on October 26th at 263 Monitor St., Green Point, Brooklyn, fire, water and load tests will be made of Gunite floor slabs reinforced with "steelcrete" expanded metal, in order to determine the acceptability for fire proof buildings in compliance with the requirements of the fire department of New York City. The 21-foot 7-inch by 16-foot 4-inch slab 2¾ inches thick made with 1 to 3 Gunite with panels of 6-foot 3-inch, 18-foot 6-inch and 6-foot 10-inch spans loaded to 40, 150 pounds and 50 pounds respectively, will be subjected to 1700 degrees temperature, quenched with a 60-pound hose jet through a 1⅛-inch nozzle. Applied for 5 minutes on both upper and lower surfaces of the slab.